This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

3 3433 06633114 5

PURE

AIR, OZONE AND WATER

A PRACTICAL TREATISE OF THEIR UTILISATION AND VALUE IN OIL, GREASE, SOAP, PAINT, GLUE AND OTHER INDUSTRIES

BY

W. B. COWELL

TWELVE ILLUSTRATIONS.

LONDON
SCOTT, GREENWOOD & CO.
Publishers of Technical Works
8 BROADWAY. ~~19~~ LUDGATE HILL, E.C.
1900

[*All Rights Reserved.*]

THE NEW YORK
PUBLIC LIBRARY
737168
ASTOR, LENOX AND
TILDEN FOUNDATIONS
R 1916 L

NEW YORK
PUBLIC
LIBRARY

PREFACE.

As the necessity of the obtainment of a supply of pure air and water is essential to the life and growth of all organic matter, so in like manner is it important that those industries dealing with such substances should receive a similar treatment in the course of their manufacture into the various compounds for which they are employed.

A practical treatise, therefore, of the purification of air and water, also the generation of ozone, and their utilisation in oil, grease, soap, paint and glue manufacture, and the benefits derivable therefrom, must necessarily prove of intrinsic value to those trades, likewise to other industries requiring similar commodities.

The value of pure air for oxidation, purification, etc., is well known, but its practical utilisation by means of cheap methods have not until recent years been fully realised.

The methods of utilisation herein described will be found very simple in application—at the same time most effective.

The importance of using soft water is fully realised in all departments of manufacture, as the destructive power of hard water is considerable.

Every degree of hardness destroys 1·7 lb. soap, $1\frac{1}{2}$ oz. caustic soda, $1\frac{3}{4}$ oz. carbonate soda per 1,000 gallons water respectively.

Hard water is most deleterious to colours, imparting thereto a dull appearance instead of the brilliancy desired.

The incrustation of boilers, etc., and the detrimental effects of using hard water for almost any purpose, renders it most necessary to employ means for its purification before usage.

These must, however, be cheap, and it will be found that the processes described herein not only fully comply with this demand, but are likewise fully effective in their operation.

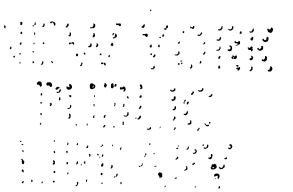
The book is written solely for manufacturers, and will be found thoroughly practical throughout.

The language used in describing the various

methods is as simple and comprehensive as possible, every phrase of technicality being carefully avoided.

In submitting same for their consideration and approval, the writer trusts that some, at least—if not all—of the information contained therein will be found serviceable for their respective industry.

I should like to express my indebtedness to Mr. George H. Hurst, Analytical Chemist, the author of several valuable works on the paint and allied industries, for useful help rendered by him in the preparation of this work and in the reading of proofs.



NEW YORK
PUBLIC
LIBRARY

CONTENTS.

CHAPTER I.

PAGE

ATMOSPHERIC AIR 1

CHAPTER II.

COMPRESSED AIR 25

CHAPTER III.

LIQUID AIR 28

CHAPTER IV.

PURIFICATION OF WATER 31

CHAPTER V.

FLESHINGS AND BONES 44

CHAPTER VI.

OZONISED AIR IN THE BLEACHING AND DEODORISING OF FATS, GLUES, ETC. 52

APPENDIX OF GENERAL INFORMATION 65

INDEX 83

CHAPTER I.

ATMOSPHERIC AIR.

THE value of air as an accessory in manufacturing processes was, until recent years, practically unknown.

The discovery of the process of oxidation of oils by atmospheric air, however, opened up a wide field for its use, which has grown to such an enormous extent that the process has now become quite an established and valuable appendix to the trade.

In the manufacture of colours which require to undergo oxidation during the process atmospheric air is now also being used, and has been found very profitable and efficient, specially with Prussian blues.

With these exceptions, and those of the few up-to-date manufacturing firms, the use of atmospheric air is still very limited; but, considering the multitudinous purposes to which it can be employed, and the unlimited quantities everywhere obtainable,

there should be nothing to hinder it being universally adopted, as the cost for pumps, etc., is not great and the saving in cost of labour, etc., would speedily repay the outlay.

There are two ways in which atmospheric air can be used, viz., wet and dry. The wet method is available where moisture is not a detriment, and the air pressure, therefore, can be obtained by the direct aid of steam injectors; whereas, if the air is required dry, the service of an air pump is necessary.

Fig. 1.

The Wet Method.

An X L ejector shown in Fig. 1 is the simplest, cheapest, and most effective piece of mechanism to use, as it can be utilised either for agitation or lifting at will. When fixed to coppers, pans or vats, the best way is to place the ejector on the main steam pipe leading thereto; and, if direct steam is also required, to secure it by attaching *a by-pass* from each side of the ejector with the

aid of tees, bends and steamcocks. It is advisable to run a pipe from the suction end of ejector through the roof or wall into the open, so as to secure pure air, taking the precaution of always protecting the inlet with wire gauze, otherwise a bird or other matter may be sucked therein and give trouble. A tap or check valve must also be placed in this pipe, so as to stop back pressure when steam alone is required.

Agitation.

In this way thorough agitation is procurable at any desired temperature up to 180° F., and sustained thereat for an indefinite period, and will be found most suitable in carrying out the following work :—

Washing and clarifying of oils, fats, etc.
Simmering of bones, rough stuff, dregs, etc., for extraction of fat.
Agitation and boiling of soaps.
Manufacture and blending of colours and mordants.
Extraction of dyes from bark, dyewoods, etc.
Resin and tar distillation.
Lixiviation of lye, softening of water, etc.

The great superiority of air agitation over that of manual labour is so marked that there is practically no comparison between the two.

However perfectly the work may be done by hand, the mixing of the mass is only partially accomplished; whereas, by the use of the air agitation described above, complete permeation is immediately obtained, also a perfect, continuous commingling achieved for hours, if desired, without cessation. Some manufacturers use mechanical stirrers, but these are not very satisfactory. The following are some of the great advantages derivable from the usage of steam and air in conjunction, viz.: increased purifying and sweetening power, especially when applied to animal or other organic matter; the absolute control and suppression of offensive smell which unavoidably arises from open pans (a matter of great importance to manufacturers whose works are situated in or near towns): a twofold vexatious evil is thus successfully overcome; the exacting requirements of the sanitary authority (a body very difficult to please) are successfully met; while an immense advantage is secured to the men who, under the old manual system, have to stand over the pans, coppers and vats continually whilst working, and so inhale the noxious fumes arising therefrom. These frequently overpower them, especially during hot weather, and are the cause *of much illness*. These benefits alone are a great

desideratum, and should induce manufacturers to adopt the system. But there is still another great boon—the saving of labour. By the use of steam and air a couple of men would be able to do the work of at least half a dozen men by the ordinary method, and to do it more comfortably, speedily and effectually. Such an immense saving would alone rapidly repay the necessary outlay, leaving out of consideration entirely the other benefits specified. These advantages, therefore, should lead to the immediate adoption of the system by all manufacturers.

The size of the ejectors most suitable to use are as under :—

For vats up to 5 tons, $\frac{3}{4}$ in. inlet and 1 in. discharge is sufficient.

For pans and coppers where simmering is only desired, $\frac{3}{8}$ in. inlet and $\frac{1}{2}$ in. discharge will be found ample for such work.

The most suitable material to use for carrying away the noxious fumes is ordinary cast-iron stove pipe, which is light, cheap and readily obtainable.

The two sizes required are 6 in. and 8 in., the latter being used for the main discharge and the former as tributary thereto.

This arrangement, however, only applies to small

coppers and pans; for larger vessels it is necessary to use the 8 in. throughout.

The main pipe should be placed over the coppers, etc., and fixed at such an elevation as to operate on the whole plant.

Care must be taken to give this pipe a slight drop toward the discharge end; also, in making any connection therefrom, to fix the T-piece in a horizontal position, so that the condensed vapour is carried away without the possibility of flowing into any of the other pipes.

This latter precaution is very essential, as otherwise, in working one vessel, the next in rotation would receive the condensation therefrom.

The hoods for round vats, etc., are best made funnel-shape, the bottom end being sufficiently large to overlap the sides some 2 in. and the top to just slip over the main discharge pipe, so that it can be telescoped thereon when required to be raised.

This can be done mechanically by attaching a ring on each side of the funnel, and by means of ropes or chains run through an overhead pulley and counterweighting the same, thereby enabling the cover to be easily raised or lowered at will.

It will not be found necessary, however, to raise the hood whilst working, as, the apex of discharge

being central, the vapour or steam is drawn to that point, therefore permitting observation holes to be made in the cover.

These can be made disc-shape or otherwise with a swing or sliding cover as preferred, the circular shape, however, being much stronger and less liable to buckle.

FIG. 2.

In Fig. 2 is given a sketch of a round pan so fitted.

With square or oblong tanks roof-shape covers will be required.

The materials best adapted for this class of work are thin charcoal plates riveted together, which are very light and durable.

In respect to small pans and coppers the covers for these are generally made of wood, but this

material is most objectionable, as it speedily gets saturated and often smells worse than the contents.

Cast-iron covers from $\frac{1}{8}$ in. to $\frac{1}{4}$ in. thick are the most serviceable.

To enable the exhaust pipes to be fitted, it will be necessary to have at least one-third of the cover bolted on to the rim of the pan and the other part

FIG. 3.

attached thereto by means of claws or hinges, so that it can be raised up and down by the same arrangement of a pulley, etc., as already described.

For the purpose of support and stability it is advisable, in fitting the exhaust from pan to the main discharge pipe, to duplicate it at the pan end.

This is done by means of two bends and a T-piece, as shown in Fig. 3, but if a number are required it will be cheaper to have them cast in one, which would enable flanges to be added to the bottom orifices. If, however, stock pipes are used, drawn flanges of soft steel will have to be made and sweated on in the usual way to enable the fixing thereto of the cover.

The T from the main pipe will require one end reduced to 6 in.

An elbow or bend connected thereto, with the necessary straight length added, will enable the junction with pan to be completed. A good caulking composition, composed of 3 parts white lead, 1 part red lead, and 1 of silicate of soda (100 Tw.) in conjunction with spun yarn (free from jute), will be found to make good tight joints.

The silicate of soda must not be added to the mixture of the white and red leads until actually required, as it sets hard in a few minutes.

Having explained the method of connecting the vats, coppers and pans to the main exhaust pipe, the final discharge must now be considered.

This should be carried so that it can be finally connected into a boiler flue or shaft; or in the event of vertical boilers, under the furnace, the latter being

preferable in every case where possible, as by this means everything passes through the fire and is consumed.

In the event, however, of volatile matter of an inflammable nature being worked, an independent shaft should be erected.

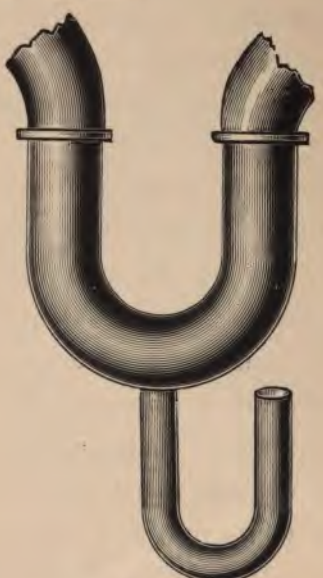


FIG. 4.

By this means the necessary vacuum is attained, but to prevent any surplus condensed aqueous matter passing through as well, the discharge pipe, before finally connected into the shaft, etc., should be made U shape so as to catch such matter.

At the bottom of the U, drill a 2 in. hole and insert therein a bend. On to this screw a duplicate so as to form a U also, as shown in Fig. 4. By filling this with water it will act as a seal and enable any accumulation in the larger pipe to run away automatically and continually without further supervision. Should, however, the vacuum prove too strong, make the seal deeper until the water is retained, keeping the return to the original height, but do not go higher, otherwise water will always lie in the main pipe, which it is desirable to avoid.

Thus the whole of the vapour and fumes arising from the vats, pans and coppers are completely and successfully carried away.

Lifting of Liquids.

For charging or discharging of any vessel the X L ejector will be found of great service. The most effective way to utilise the ejector for this purpose is to place it at the bottom of the tank in which it is required to work, thereby keeping it cool, the pressure of the liquid also assisting in enabling it to "fetch" the liquid and retain it.

It is not to be depended upon, however, if the temperature of the liquids exceeds 120° F., but below this it will readily lift to a height of some

25 ft. and throw to a distance of 60 ft., especially if the steam pressure equals or exceeds 60 lb.

In Fig. 5 is shown the method of using the

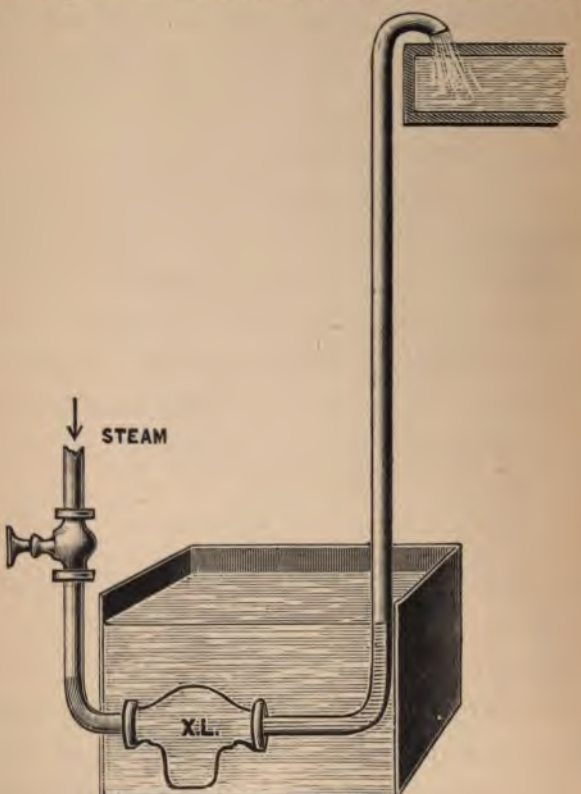


FIG. 5.

ejector for lifting liquids from one tank to another

For liquids above this temperature, also for those which require to be kept free of moisture

the lifting must be done with an air or donkey pump.

This can be achieved either by suction or pressure—the latter by means of a closed tank. If the former is adopted, the pump should be placed below the level of the tank from which it is operating, so that the liquid can feed thereto by its own gravity, otherwise it will not work satisfactorily.

The Dry Method.

In oil and grease factories the great saving of labour and time attainable, and the numerous uses to which dry air can be applied, renders its use imperative—that is, if the principals desire to hold their own in open competition. By its use the ordinary filtration for the purpose of clarification becomes a thing of the past. Filter presses (except where liquids from solids have to be separated) become obsolete, as by the use of atmospheric air what formerly required some ten days to clarify is now achieved in less than two hours.

There is also the saving of cloths, breakages, etc., that commonly occurs when working filter presses. By this method brighter oils, etc., are obtained, very sweet in smell and much superior to those obtained by ordinary filtration.

At 160° F. air will evaporate 4 grammes moisture per minute, *i.e.*, one-seventh of an ounce.

For the production of a current of dry air it is best to use either a blower or an air-pump.

Fig. 6 is a drawing of a blower worked by a

Fig. 6.

belt from a shaft. This blower gives a good current of air at a fair pressure and with a steady running of the power at a uniform flow, which is much to be desired in this kind of work.

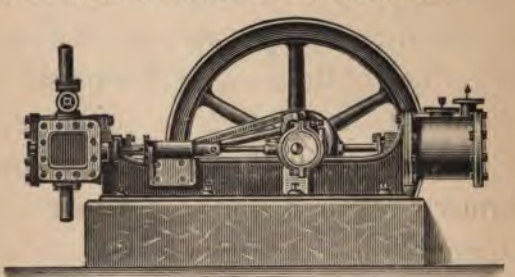


Fig. 7.

Fig. 7 is a drawing of an air-pump or air compressor worked direct from a steam engine. It is always advisable when using such pumps to connect *them with* a storage tank or accumulator in which

the air can be kept under any required pressure, and from which it is conveyed by pipes to the pans or tanks containing the oil, etc., to be operated on.

Fig. 8 shows a form of air compressor which may be driven by belting from a main shaft—a method which is often more convenient than direct steam driving.

Under no circumstances should holes be per-

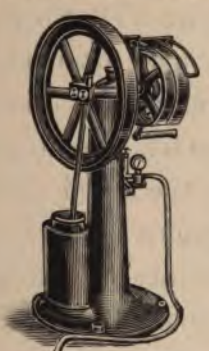


FIG. 8.

forated in the coil on the side butting against the wall of tank, etc.; otherwise holes will sooner or later appear in the tank, on account of the continuous impinging of the steam or air thereon.

This is a most important point to note, otherwise the contents of a tank may one day be found missing.

With circular tanks, when the bottom is made

funnel-shape (a pattern now almost universally adopted), a straight central pipe extending nearly to the bottom and ending cup-shape is by far the most effective agitator to use, on account of its cyclonic action, thereby thoroughly permeating the whole contents.

By passing the air after leaving the pump through the boiler flues (in large boilers these sometimes stand at 500° F.) by means of a coil a great saving is also attained.

For blowing operations this will be found very beneficial, likewise for blending, mixing and melting purposes, also for the clarification of oils and fats, evaporation of liquors, etc.

Oil tanks can also be kept warm during the winter months, and articles of all kinds can be dried. There are numerous other uses to which it could be profitably employed, as very little steam would be required for driving the air-pump continually, if so desired.

The service of steam-jacketed pans become thus practically unnecessary.

A by-pass would have to be fitted or a separate pump employed when the air is required cold for cooling purposes, or the temperature of the hot air reduced.

For the rapid cooling of oils, bone grease, melted stuff, tallow, etc., blowing cold air through is invaluable, thoroughly breaking the grain of the fats, imparting a bright appearance, the whole of the moisture practically being driven off in the operation, giving them also an agreeable smell, and thereby increasing their market value.

Do not exceed a temperature of 170° to 180° F. in the drying or blowing of oils, otherwise the colour will suffer considerably.

In thickening or drying oils "gate" or full way valves are the best to use, as the full force of the air is thus obtained.

It is also advisable to insert an automatic check valve as near the tank as possible, specially when the air-pump is driven by a belt, as instances have occurred where, owing to the belt breaking or skidding, the whole of the contents have syphoned back.

Pressure and Vacuum.

Judging by the erratic way in which some manufacturers work with pressure and vacuum, one would suppose it was a matter of chance rather than a natural law.

The saving of time has always been the excuse

for such procedure, but when it is accomplished at the risk of fire and life the risk is too great.

Pressure may be safely used to its maximum obtainable degree, provided provision is made for the control of the corresponding vacuum, which is always exactly half the pressure obtainable, or *vice versâ*.

The best and simplest way is to connect the pressure and vacuum pipes, placing a tap in the centre of the connection, which thus enables the operator to control same at will.

Suction Process.

Besides blowing dry air direct through fats and oils, which necessitates the use of a blower or pump, air may be drawn through by a suction process, using an ejector. On this principle is constructed Korting's apparatus for bleaching palm oil shown in Fig. 9. It consists of a closed iron vessel, on the upper part of which is fixed a steam ejector, C, so arranged that the steam entering at a draws air out of the vessel at g. b is a valve for regulating the admission of steam. K, K, K, L, is a copper steam coil for heating the oil, and keeping it in a melted condition. E is an open air pipe, *partly* outside and partly as a coil inside the vessel

this latter portion is perforated with a number of small holes. The action of the ejector is to produce a vacuum in the upper part of the vessel, and in order to reduce this vacuum air enters through the pipe E, and issuing from the small holes in the distributing pipes passes through the oil, with which

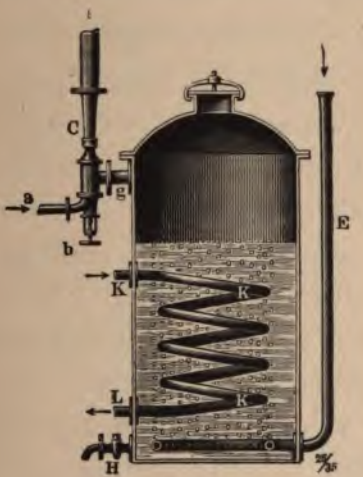


FIG. 9.

it comes into very intimate contact, and the oxygen it contains can exert its full bleaching action. The operation takes about two hours; when, as a rule, the palm oil will be bleached to a good white colour. A few minutes' attention at the start of the operation to see that the oil is melted and that a good current of air passes through it is all

that is needed. Towards the end of the operation samples may be drawn from the cock, H, to see if the oil be properly bleached.

Practically the same apparatus may be used for clarifying oils, for removing water from oils and fats, blending and brightening oils.

Preparing Blown Oils.

Reference has been made to the blowing of oils or the preparation of "thickened oils," such as thickened rape oil or lardine (thickened cotton oil). For this purpose the oil is placed in a tank fitted with a closed steam coil, so that the oil can be heated to from 160° to 170° F. The latter temperature is quite high enough and should not be exceeded, especially if pale oils are wanted. The higher the temperature the darker the oil becomes. For blowing the air through, either a blower or an air-pump may be used, and the blowing is carried on until a sample taken out and tested by an hydrometer shows that it has acquired the desired degree of gravity. This may vary from 0·960 to 0·975 at 60° F., according to requirements; at temperatures of 150° to 170° F. the gravity will be less, and if the oil is being *prepared at* 150° F. then an allowance of 0·031

may be made. That is, if the oil shows at 150° F. a gravity of 0·929, it will have at 60° a gravity of 0·929 + 0·031 = 0·960. For 160° F. the allowance is 0·035, and for 170° F., 0·038.

The blowing of the oils is accompanied by a bleaching action more or less, and the lower the temperature at which the work is carried on the paler will be the resulting oil. In the case of lardine the appearance and odour will depend largely on the quality of the cotton oil used, the freer this is from stearine the less odour will the thickened lardine oil have.

Preparing Siccative Drying Oils.

The blowing of hot air through linseed oil, while it is being boiled for the preparation of drying or boiled oil for painting, will enable the process to be carried on quicker and a better product obtained.

Aerification.

A great deal of trouble has been experienced by many manufacturers in their effort to use atmospheric air, which has resulted, in some instances, in its temporary abandonment; but on investigation, the failure in every case has been traced either to insufficiency of the pumping

power employed for its utilisation, or to
excessive head pressure of the substance un
treatment.

The author has succeeded, by a very sim
method, in overcoming these difficulties, as sho
in Fig. 10.

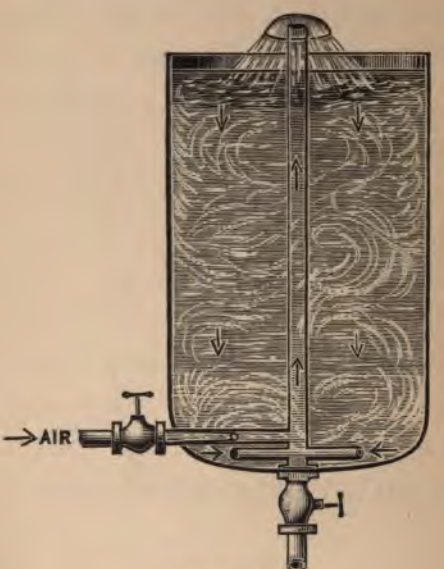


FIG. 10.

It will be seen there that the method of appl
tion is totally different to that ordinarily emplo
the agitation in general practice being invari
set up from below, and forced upward through
whole bulk of the liquid requiring power pro

tionately to the head pressure present, whereas here it is confined to a very small circle, and consequently retains its original pressure throughout.

The benefits derivable therefrom are readily conceivable.

The air-pump employed can be much smaller than that required by the ordinary way, whilst the agitation being wholly confined to the surface achieves a threefold action, viz., dual aerification and purification, whilst the liquid is continuously being cooled throughout the whole operation.

Practically the action is that of an ejector, the whole of the liquid being carried round and round, thus ensuring every part being brought into actual contact with the air, which facilitates considerably the desired end, and is therefore invaluable for the following :—

Clarification of oils, fats, etc.
Evaporation and condensation of liquors, such as size, etc.
Oxidation of lubricating and siccative oils.
Rapid cooling of tallows, greases, etc.
Saturation of solids with aqueous or chemical solutions, such as hides, etc.
Washing, dyeing or bleaching of fabrics.
Extraction of gelatinous and fatty matter from bones, etc.
Effective mixing of liquids and compounding of oils ; also for numerous other purposes.

In the treatment of solids it will be necessary to fix a false bottom in the tank for the saturating liquid, which should be perforated so that the liquor can return thereto after percolation of the substance under operation. By this means same not only becomes saturated, but is drained also. The air and suction pipes must of course extend below the false bottom for such work.

In the blowing of lubricating and siccative oils for the purpose of oxidation, cooling water is entirely dispensed with, the subjected temperature, especially if hot air is employed, being most uniform.

Sufficient has been said to fully demonstrate that in the adoption of atmospheric air there lies quite a *multum in parvo* of benefits derivable therefrom.

Further, its acquisition is obtained without additional cost after the first outlay.

Waste energy is also utilised, and everything as far as possible carried out by mechanical means.

Manufacture is carried out at less cost and in a much shorter time. The sanitary condition of the factory is also vastly improved.

Labour and fuel are greatly reduced and workmen are made comfortable.

CHAPTER II.

COMPRESSED AIR.

THE compressing of air is making rapid strides, and is adopted in all classes of manufacture.

The variety of uses to which it is now being put is very large; and, judging by the increasing demand, it will be used much more extensively in the future, as its tensive power exerts great energy in utilisation.

It is compressed up to 1,000 lb. per square inch, according to the class of work for which it is required to operate.

It will be found most suitable for the following purposes :—

Raising of acids.
Cleansing of factories.
Whitewashing.
Ventilation.
Cooling of liquids.
Drying of solids.
Paint spraying.
Cranes, elevators, etc.

For these classes of work a pressure of some 75 lb. would be found ample.

In the cleansing of factories it is very effective in removing all dust, etc., from walls and roofs.

The whitewashing of walls is thereby accomplished easily and rapidly.

In using it for this purpose an X L ejector can be utilised for lifting the lime-wash in the same way as with steam and air, connecting on the delivery side a strong armoured hose fitted with tap and spray spreader, or other suitable appliance, as shown in Fig. 9.

The same method could be adopted in paint spraying. Painting in this way is very satisfactory —a very thin and even coat being spread by this method.

The conveyance of cold liquids (except acid) could also be speedily and effectually achieved in like manner.

For ventilation, drying and cooling, the low temperature of the air would prove of great service.

In the lifting of acids the safest way is by direct pressure from a closed tank.

Whitewash.

The following mixture will be found most advantageous to use where organic matter of any description is present: 40 lb. lime, 14 lb. salt, 2 lb. naphthalene, made up after slacking to 100 gallons.

Fig. 11.

CHAPTER III.

LIQUID AIR.

THE recent successful liquefaction of air has opened up such a field of resource which, if it can ever be produced on a commercial basis, would completely revolutionise its whole system.

It is too early, however, in the day to be able to prognosticate the future with certainty, as at present the cost of its manufacture is far too high for practical utilisation.

The difficulty of cheapening its production is very great, and will require a lot of surmounting.

"Twenty-three thousand five hundred foot-pounds of work are required to compress 1 lb. air," although "it is calculated that in 1 foot-pound liquid air there is stored 139,100 lb. energy."

Accepting these figures as correct, the cost of manufacture is still much too high for practical utility.

The critical temperature of air is so low (- 158° C.) that its attainment alone is very

difficult ; and, as the liquefaction point is still lower, the energy expended in compressing is considerable.

The line adopted by Professor Dewar is, in the writer's opinion, the only feasible method whereby ultimate success may be obtained, viz. :—

Retrocession.

Liquid carbonic acid was used by him in the primary stage through which the air is passed by the aid of an inner tube whereby the heat of one was transferred to the other by simple substitution.

The air by this means was thus reduced to a temperature of − 79° C. or − 110·2° F. at a very small cost as in practice the gasified carbonic acid could be re-liquefied over and over again.

This temperature, however, is far above the liquefactive point, but, if other suitable substances could be used in conjunction, the gradual liquefaction of air might be eventually accomplished commercially, and would prove a grand chemical attainment.

Flowery descriptions of its available application should at present be received with extreme caution and in a measure only conditionally ac-

cepted until further research has been made thereon.

The liquefaction of hydrogen was a feat even more difficult to attain, and its successful accomplishment therefore encourages us to wait patiently before expressing ourselves definitely either way.

CHAPTER IV.

PURIFICATION OF WATER.

WATER plays a most important part in industrial operations of almost every kind. For the purpose of raising steam for motive power its use is universal, while it is an essential element in many manufacturing operations. A supply of pure water is therefore most essential, not only for use in boilers, but also when it enters into industrial processes. Natural waters are rarely pure, but contain various metallic salts in solution. It is a matter, therefore, requiring the closest attention, as otherwise the injurious influence arising from the use of impure qualities of water may not only retard operative results, but may also become a costly item in the way of general manufacture by increasing the costs of certain processes.

The water supplied to towns by the water companies is no doubt the safest source of supply generally procurable, but the high price often charged prohibits its common use. Therefore

works have to provide their own supply from any available source.

The cost of sinking artesian wells is very small where river or spring water is unavailable, and rapidly repays the outlay.

Factories should always be built on the water side, as the benefits derivable from such a position are many.

The principal impurities generally found in water are :—

Carbonate lime.
Sulphate do.
Carbonate magnesia.
Sulphate do.

with traces of iron, silica, alumina, salt, etc.

The carbonates of lime and magnesia and the sulphates of those bases which are invariably present in natural waters impart what is known as "hardness," a property more readily appreciated than described. The presence of these compounds in water, when it is used for steam-raising purposes, leads to the formation of scale which is very deleterious, while they sometimes interfere with other operations.

The degree of hardness—temporary and permanent—varies very much, from 4° or 5° to 18° to

20° in water supplied by London water companies, and is most detrimental to boilers, etc.

The effectual removal of the lime and magnesia compounds from water has been a very vexed question, upon which much time, energy and money has been expended with only a limited amount of success. With hard waters it is advisable to adopt means to prevent them forming hard scale in boilers.

The market is continually flooded with compositions for the removal or prevention of incrustations in boilers, none of which can, however, be recommended as being perfectly satisfactory, as it is practically impossible to effectually blow out the mud, etc., from a boiler so deposited, as the clearance radius rarely extends more than 3 feet from the blow-off hole, on account of the vortex formed by the head pressure on the point of discharge.

The accumulation of some deposit is therefore unavoidable, and, if allowed to materially develop and form hard masses is most injurious to the boiler, specially if it be fitted with Galloway tubes, their shape seeming to make them adapted for the retainment of such deposit.

Scale in boilers leads to two evils: corrosion of the boiler plates and increased cost of raising

steam, for scale is a very bad conductor of heat, and a scale ½ inch thick will more than double the coal bill.

The only way to accomplish its complete removal is to use a scale preventive that will keep the deposit in the form of a fine mud, which can be removed by placing along the bottom of boiler, from end to end, a perforated pipe fitted with a T-junction passing through the upper half of the boiler shell, and fitted with a screw valve, to which can be affixed a rotary pump or other lifting appliance, by which means the whole of the deposit can be periodically drawn off.

Wherever possible, it will be found cheaper to purify the water before use, by which the whole difficulty is practically overcome in one operation.

For softening water the erection of two store tanks is necessary, each of sufficient size, if possible, for the whole day's requirements, so that whilst one is in use the other can be undergoing preparation for the next day.

Old boilers are very suitable for this purpose.

For boiler use an independent feed tank of some 1,000 gallon capacity will be found very beneficial, *as then the* exhaust pipe from engines, etc., could

be passed through the same, thereby achieving a twofold benefit of heating the feed water and so saving fuel under the boiler and condensing without cost. This water can be used over again in the boiler, and will also be found very useful in various other ways wherever it is found essential to use a soft water, but it is advisable to first run it into a separate tank so as to allow any grease or oily matter to separate therefrom before utilisation.

Some manufacturers use steam traps, whilst others pass the exhaust into water direct, neither of which is, however, profitable on account of the enormous back pressure which is thereby produced.

Out of the multitudinous compounds available and used for the removal of impurities from water, the writer has found a mixture composed of the following ingredients to achieve the best all-round results of any :—

98 % Powdered caustic soda . .	10 lb.
Permanganate potash . . .	2½ oz.

dissolved in 10 gallons water.

The quantity required to be used for each 1,000 gallons of water will vary from ½ to 2 gallons,

and depends upon the amount of impurities contained therein.

To gauge this exactly take 70 C.C. of the water which is to be softened and pour it into a 250 C.C. glass flask.

Having done this, fill a burette (50 C.C. being a suitable size) with a standard solution of soap. Drop the soap solution from the burette into the water in the flask, shaking at intervals until there are signs of a soapy appearance, and a permanent lather is obtained, which should not disappear for at least five minutes after treatment.

The number of cubic centimetres used of the soap solution gives the number of degrees of hardness of the water and approximately the number of grains of carbonate and sulphate of lime per gallon.

Roughly, 1 grain of the purifier given above will neutralise 1 grain of carbonate or sulphate of lime, and so the number of cubic centimetres used represent the number of grains of purifier to be added to 1 gallon of the water. The liquid purifier herein given contains about 8,000 grains of active purifying properties per gallon, so that it becomes comparatively easy to calculate how much to add *to each* 1,000 gallons of water.

For instance, a water on testing shows that it has 12 degrees of hardness, therefore 12 × 1,000 equals 12,000 grains of purifier to be added to 1,000 gallons of the water. One gallon contains 8,000 grains so that 12,000 divided by 8,000 gives 1·5 gallons as the quantity of purifier to be added.

Should the water contain, as most river waters do, a large quantity of suspended matter, its clarification will be greatly facilitated by using in addition to above ¾ lb. sulphate alumina to each gallon of the purifier required. This must not, however, be added to the purifier, but introduced separately.

The tank being filled with water and the quantity gauged, it is well agitated by blowing air and the requisite amount of purifier added, and the agitation continued for about an hour, and then allowed to settle.

Water treated in this way will be found very soft and suitable for almost any description of work.

The permanganate potash oxidises all organic matter commonly present in rivers, etc., removing also the flatness from sluggish or stagnant water.

Air agitation also may be very beneficially used for this purpose.

This purifier is also excellent as a preventative of scale in steam boilers. Owing, however, to the varied sources from which canal and river waters come, and their liability to contamination by extraneous substances, especially when flowing through manufacturing districts, it is not found possible to fix definitely upon a purifier that will answer universally for all waters. It is advisable, therefore, at first to ascertain by analysis the exact nature of the impurities present, so that the purifying agents used may have a direct affinity to the substance required to be extracted. These are of various kinds, but are limited somewhat by reason of cost, those generally used being as under :—

Caustic lime,
Caustic soda,
Carbonate soda,
Sulphate alumina,

by which, either alone or combined, the purification of most waters is accomplished.

Caustic lime is used in the form of lime water.

This is prepared by first slacking the lime and then mixing it in the ratio of 1 lb. to each 120 gallons water, and kept well agitated for about half an hour, after which it is allowed to settle until it becomes clear, when it is ready for use, 100

gallons for each 1,000 gallons river water being the quantity generally required. Caustic and carbonate soda are generally used in solutions of 1 per cent. strength, the quantity requisite for river water being about 1½ and 1¾ lb. respectively.

Sulphate of alumina.—The quality generally used for water purification is that known commercially as aluminoferric, but it is a question whether it is not cheaper to pay the small additional price charged for the pure article, as it is more effective, and consequently requires the use of a smaller quantity.

This article is used in conjunction with either lime or soda, the quantity required per 1,000 gallons river water being about 8 oz. dissolved in 10 gallons water.

The following combinations are found to give very satisfactory results, and will enable manufacturers to choose the most suitable method for their particular requirements :—

1. Lime and Alumina.

100 gallons lime water.
10 gallons alumina solution.

2. Lime, Soda and Alumina.

50 gallons lime water.
1 lb. 98 % caustic soda (dissolved in the lime water).
10 gallons alumina solution.

3. Caustic Soda and Alumina.

15 gallons caustic soda solution.
15 gallons alumina solution.

Carbonate of soda is rapidly falling into disuse for the purification of water, as its action is too slow, especially where the process is continuous; also because it cannot be mixed with the lime water like caustic soda.

The quantities given above are sufficient for the treatment of 1,000 gallons water containing 12 degrees of hardness.

The sulphate of alumina must never be mixed with the other ingredients, but added separately, otherwise they will be decomposed thereby, and consequently rendered ineffective.

If the quantity of water required necessitates a continuous process being employed, it will be necessary for the purifying agents to be run into the softening tank in proportion to the inflow of water, for which purpose tanks of sufficient capacity must be provided, fitted with cocks, so that the requisite flow can be gauged respectively.

These should be placed directly over the softening tank at places most convenient for working.

Those for the lime water should be duplicated,

so that whilst one is operative the other can be recharged.

The tank for the alumina should be made either of slate or wood with a lead lining, and not put into iron tanks as it corrodes them.

To rapidly clarify the water, filtering tanks should be placed below the level of the softening tank, which can be filled with coke or other suitable filtering medium to within a few inches of the overflow. A double blanket is then laid thereon, between which a sheet of fine calico is placed, and the whole clamped down with perforated iron plates specially made so as to exactly cover the whole surface.

The feed thereto from the softening tank is fixed on to the bottom, so that the water is thereby forced upward through the filtering area by its own weight, and passes from thence direct into the store tank for utilisation.

In drawing the water from the softening tank always take it from the top, as by this means a large proportion of the impurities settle therein, and so render the filters more effective.

This is best achieved by dividing the tank into three sections.

Into the first section the impure water is treated

with the purifying agents and well agitated with air, which then overflows into the second chamber. In its passage to the third section the inlet thereto is reversed, entering from below, through which it rises until it reaches the overflow pipe or pipes leading to the filters.

To flush the filters a T-piece should be inserted into the pipe leading from the softening tank, so that the water can be diverted and enter from above when so desired. A T-piece should also be fitted below, so that by means of adjustable cocks the deposit laying in the filters can be washed away.

By this means large quantities of water can be purified with satisfactory results.

The standard soap solution referred to on page 36 is made by dissolving 10 grammes Castile soap in one litre (1,000 C.C.) of 35 per cent. alcohol, *i.e.*, 700 C.C. distilled water, 300 C.C. of 60 O.P. methylated spirit. The soap is cut into small pieces and carefully weighed. It is then added to the alcohol, and a gentle heat applied thereto by means of a water bath until the whole is completely dissolved.

Water Hardness.

Quantities of the various bodies generally found

impure water required to produce one degree of rdness :—

	Grammes.
Calcium oxide	·0057
,, chloride	·0114
,, carbonate	·0103
,, sulphate	·0140
Magnesium oxide	·0042
,, chloride	·0050
,, carbonate	·0088
,, sulphate	·0125
Sodium chloride (common salt) . .	·0120
Sodium sulphate (Glauber salts) . .	·0146
Sulphurous acid	·0073
Carbonic acid gas . .	5 cubic centimetres.

CHAPTER V.

FLESHINGS AND BONES.

UP-TO-DATE methods in this important branch of manufacture seem to be receiving very scant attention at present, judging by the primitive methods still employed in some of the large works, thereby severely handicapping their position in competing with foreign productions obtained by using the latest known methods, and with the best labour-saving machinery obtainable.

To conduct business handicapped in this way, without the employment of methods used in the most modern works, means eventual ruin, or at the best only a comatose existence. It is therefore with the object of removing some of the lethargy now existing that this chapter is written, the time being specially opportune by reason of the increased demand and the improved prices now prevailing.

Atmospheric air, either alone or in conjunction with steam, plays the principal part in accomplishing

these improvements, the effect in some instances being simply marvellous. Special attention is therefore directed to the descriptive particulars for its utilisation and usage.

The drying of gelatine and glue is always a very delicate process, but by the use of air it can be carried out with rapidity and confidence.

It is well known also that by the continuous boiling of chondrine it is convertible into gelatine, especially if made from fresh material, but by the use of air oxidation this change is considerably facilitated, with profitable results.

The quantity of sulphurous acid required for bleaching of glues, etc., is considerably reduced if not wholly superseded by air, any remaining impurities being taken away by the use of a powerful oxidising agent, such as permanganate potash, or an astringent as sulphate alumina, *but not alum.*

Very weak solutions, containing not more than 1 lb. in 10 gallons, should be used, and the exact quantity required for the bulk under treatment ascertained by titration test of a sample 100 C.C. before treating the bulk.

This is very necessary, specially in using the astringent, otherwise coagulation will follow if much chondrine is present, but for the purpose

of purifying gelatine this property can be utilised and the astringent added until the whole of the chondrine is precipitated.

If desired the alumina can be wholly extracted from the liquor by means of ammonia or any of the fixed alkalies after the above or any operation. But this is not necessary.

On glue size from bones the degree of clarification by this method is very marked, the colour attainable thereby being a rich sherry, instead of the dark muddy brown, as now produced.

A permanganate of potash solution will be found invaluable as a deodorant and disinfectant for floors, etc., also for judicious sprinkling of hides, skins, fleshings, bones, refuse, etc., to prevent the development of eremecautical putrefaction.

Special attention is now being given to the more careful separation of various parts of the animal for the purpose of manufacturing table jelly, meat extract, etc., as good prices are obtainable. This is a rapidly developing industry.

Fresh bullock heads and feet, also the cartilage joints, are found the most suitable for this purpose.

The heads are generally smashed, and the whole thoroughly washed with a brine of 5 per cent. strength, *i.e.*, 1 cwt. salt to the ton, until the

liquor comes away quite clear, using air as the agitator.

Great care is necessary in macerating, to extract the whole of the bloody matter before applying any heat, except in winter, when the temperature can be raised, but should not exceed 80° F.

Sufficient clean water is then added, and the temperature raised and retained from 150° to 160° F., but not higher, air still being used as an agitator until the operation is completed. Periodical stops are made to enable the fatty matter which accumulates on the surface to be removed.

The length of time requisite for complete extraction of the gelatinous matter is difficult to gauge, as the quantity treated and various other conditions affect any exact approximation. It must therefore depend at first on the skill of the operator, who, however, should be able, after one or two batches, to definitely fix and control same. The specific gravity of the liquor will prove of great service in its determination.

When finished the liquor is strained off and evaporated with dry air, at a temperature of 170° to 180° F., until the desired consistency is obtained, or it may be dessicated in the usual way.

The bones, etc., are then separated from the

meat, and the latter dried or pressed and sold for the manufacture of dog biscuits, etc., the combined operation thereby yielding a very remunerative return.

The degelatinising of bones is also very rapidly performed by the combined application of steam and air, and the maximum percentage of glutinous matter is obtained therefrom.

The passing of a current of dry air through the bones before their removal from the copper or pan after the liquor has been withdrawn would help their drying considerably, and decrease to a minimum the smell that arises therefrom when stored as they now are in the wet condition.

In doing this, keep the bottom draw-off tap open, so that the separated moisture, driven out of the bones by the air, may drain away. Hot or cold air, the latter being most preferable on account of its cooling power, may be used at discretion, which will be found to speedily accomplish the drying of the bones, and at the same time tend to sweeten them very materially.

Hitherto the evil of stacking bones in the wet condition, charged with gelatinous matter, has been a very vexed question and a sore point with the sanitary authorities, on account of the rapidity

with which putrefaction invariably takes place, in consequence of the great heat generated.

The expense to the manufacturer in the endeavour to overcome this evil has been very great, and the cause of much perturbation and annoyance in the past, as nothing tangible has been successfully introduced for its alleviation.

The only remedy is to remove the cause of the evil, which is achieved by the adoption of the method above described.

In the final treatment of rough stuff, scutch fat or dregs, use when boiling 1 or 2 lb. permanganate potash dissolved in hot water to each ton, which will be found very effective in the removal of smell, also in aiding the general disintegration of the mass, without injury in any way to the fatty matter.

Horse slaughterers will find this very beneficial to use when boiling their meat, as it imparts thereto a sweet, wholesome smell, 4 oz. for each pan being about the quantity required.

Bones contain from 35 to 44 per cent. animal and gelatinous matter, the former consisting of fat, etc., and the latter chondrine and osseine.

Gelatine proper is made principally from the skin and cellular membranes, but is also procurable in the form of osseine from bones.

Chondrine is obtained from the cartilaginous tissues.

Glue and size are, however, generally made therefrom, but there is no reason why the whole or a greater portion thereof should not be converted into gelatine by the use of air as an oxidiser, with increased profit to the manufacturer.

Average composition of the gelatinous group :—

	Gelatine.	*Chondrine.*	*Osseine.*
Carbon . . .	50·5	50·0	50·5
Hydrogen . .	6·6	6·6	6·5
Nitrogen . .	18·3	14·6	16·9
Oxygen . . .	24·6	28·5	26·1
Sulphur . .	—	0·3	—

Bones are rapidly bleached by treatment with air, which renders those which are suitable for manufacture more valuable, whilst those for manurial use are quicker and easier worked.

The fats also obtained thereby are considerably improved.

The vast improvements obtainable by the utilisation of the methods herein described, carefully and scientifically performed, should be of sufficient importance to merit their immediate adoption, as the outlay is small, whilst the value of the products derivable therefrom is materially increased, and the rapidity of manufacture greatly facilitated.

The intrinsic value in the adoption of the latest improvements has been clearly demonstrated and verified by the superiority of the articles treated thereby, so that in every way the benefits to be derived are of great monetary value, and therefore claim prompt consideration.

The importance of this class of business has been too long ignored and neglected.

CHAPTER VI.

OZONISED AIR IN THE BLEACHING AND DEODORISING OF FATS, GLUES, ETC.

THE presence of ozone in the atmosphere is essential to health.

Ozone exists in the air of woods and fields, particularly in the neighbourhood of pine trees, and wherever there is active vegetation, the percentage may range to from 3 to 5 per cent.

In large towns, on the contrary, and in houses or wherever numbers of men or animals are collected, ozone disappears, or at least diminishes considerably.

It is considered by some authorities that the disappearance of ozone is one of the causes of epidemics, its absence permitting the growth and accumulation of miasmata.

Whether such hypotheses are correct is at present undetermined, but its corrosive powers and property for destroying organic substances are known to be most remarkable.

In a concentrated form its bleaching properties are superior to chlorine.

It destroys sulphuretted hydrogen (SH_2) and rapidly bleaches vegetable colours, fats, oils, etc.

It is also a powerful oxidiser, converting indigo into isatin, black sulphide of lead into white sulphate of lead, and yellow ferrocyanide into red ferricyanide of potassium. It also transforms many of the lower oxides into peroxides.

Nitrites can be changed thereby into nitrates.

It deoxidises peroxide hydrogen and barium, which become water and baryta respectively.

The following metals are also oxidised by ozone :—

Arsenic,	Antimony,
Iron,	Manganese,
Zinc,	Tin,
Lead,	Bismuth,
Silver,	Mercury.

Ozone is insoluble in acids and alkalies.

The utilisation of ozone in the manufacture of paints and colours, also the bleaching and deodorising of oils, fats, glue, size, etc., is therefore a valuable adjunct.

Manufacturers, however, for reasons which are obvious, are handicapped in obtaining it in sufficient quantities from the atmosphere, and are

therefore compelled to resort to artificial means for its production.

A simple method for its manufacture will be hereinafter given, also the appliances described for its application upon the various articles enumerated, but before so doing a few moments spent in the examination of its composition will be found serviceable and beneficial.

What is ozone?

Various definitions are given it by different authorities, viz.:—

Electrified oxygen.
Allotropic ,,
Active ,,
Excited ,,

That of allotropic or modified oxygen seems, however, to define most accurately its constitution, as it is found that 3 volumes of oxygen condense to form 2 volumes of ozone. Ozone is 1½ times as heavy as oxygen. Ozone possesses a peculiar odour, which is observed when electrical machines are in motion, also after a thunderstorm.

To detect the presence of ozone a piece of paper steeped in a solution of iodide of potassium containing starch is used, the iodine is set free, coming in contact with the starch, the paper assumes a blue tint.

As other bodies give the same reaction, it is preferable to use reddened litmus paper dipped into a very dilute solution of iodide of potassium; ozone decomposes this salt and forms oxide of potassium: this, on contact with moisture, makes the litmus blue, which is a most reliable test.

A precaution should be taken, however, to

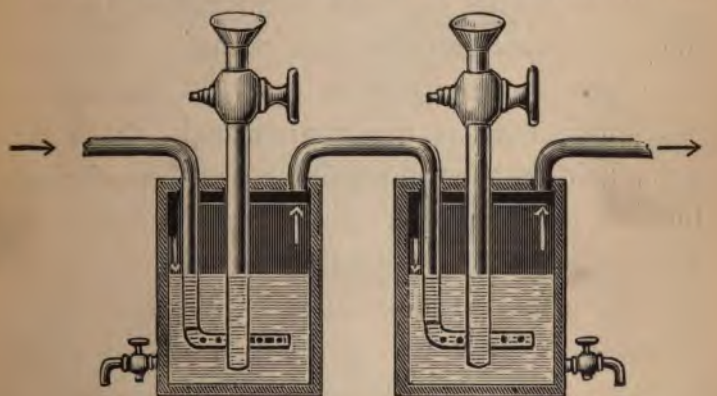


FIG. 12.

place by the side of the ozonoscopic paper another piece of reddened litmus paper, to prove that the blue colour is really due to ozone, and not to the accidental presence of a small quantity of ammonia.

Ozone, or to be more strictly correct, ozonised air can be produced by both chemical and electrical means. The former method requires the simplest and least costly appliances, but the latter yields it

the most certain and economical. The plant required to use ozone is not at all complicated and is readily fitted up.

The plant required for the generation of ozone consists of two closed tanks of sufficient size and capacity, according to the quantity necessary to be made for the work in hand, as shown in Fig. 12.

These should be fixed between the air-pump and the operating tanks, vats or pans, and should each have a capacity of at least 100 gallons.

Square or circular galvanised tanks, fitted with a manhole on the top for filling, will be sufficient; but, as the ozonising tank is charged partially with an acid, it is essential that this one should be lead-coated inside, the pipes inserted therein should be of lead.

Both tanks must be so constructed as to be capable of being hermetically closed when working.

The first vessel is charged with a caustic soda solution of 22° Twaddle, through which the air from the pump is passed for the purpose of purification.

By such operation any carbon dioxide that may be present is absorbed by the soda, such extraction being most essential in any operation where rapid bleaching and oxidation are desired.

Into the second vessel a solution of 1 lb. permanganate potash to 8 gallons of hot water is placed.

In neither vessel should the liquor used occupy more than *half* the total capacity.

Each vessel requires to be fitted with a straight pipe, entering at the top centre-end nearest to the air-pump extending therefrom to the bottom and then diverted by means of an elbow or otherwise to the opposite side, the end of which is plugged, this lower portion being perforated with holes along the top, of sufficient size to collectively equal the bore of pipe utilised, so as to prevent any check on the air admitted thereto. There is also a pipe on the opposite side of the cover just passing into the cover of the vessel. The two vessels are then connected by the short pipe on the cover of the first tank, connecting with the down pipe in the ozonising tank, the outlet pipe therefrom going direct to the vessel which contains the oil or other substance to be operated on. To the down pipe of the first tank which contains the caustic soda is connected the air pump to blow air through the apparatus.

To complete the second vessel an additional down pipe is required, reaching nearly to the bottom

of tank, which should extend through the cover and terminate funnel-shape for the purpose of adding the requisite acid to effect the preliminary decomposition of the permanganate.

This pipe is automatically sealed by its continuous immersion in the liquor, and acts also as a safety-valve.

Should, however, the pressure of the substance upon which the air is operating be sufficient at any time to break the seal, an additional length of pipe added thereto from the outside will remedy the evil.

The acid used for decomposition is 1·840 sulphuric, the quantity required being 1 gallon for every pound of permanganate potash used.

When charging this vessel, have the whole plant ready for operation, with a batch of whatever substance is to be treated in the respective tank, vat or pan, so that when the acid is poured into the permanganate solution the liberated ozone generated will pass thereto.

The air-pump can then be started, or, if desired, steam and air by means of an X L ejector, such as previously described. If, however, air alone is preferred, it should be heated to a temperature of 160° to 170° F. before passing through the ozonising liquor, either in the way demonstrated

in a previous chapter, or by other available means. A very cheap and simple way where gas is available is to heat the pipe by means of a bunsen flame, the pipe so heated being imbedded in sand or salt, which retains the heat and also prevents oxidation. The temperature can also be regulated as desired, or can be generated cold throughout if necessary.

By the wet method the steam pressure should not be under 60 lb., otherwise water will accumulate in the purifier and ozoniser and weaken their action. The former plan is therefore safer and more economical, as water can be added direct to the substance under treatment with equal effect.

In this way ozonised air is procured in a very cheap and advantageous manner, the respective tanks requiring very seldom recharging, especially in the case of the ozoniser, the recuperative power of which is most remarkable. The purifying liquor also lasts for a considerable time before it gets wholly carbonated, such being easily ascertained by titration by the usual method, and the other by the ozone test already given.

Production of Ozone from Electricity.

When a discharge of electricity is sent through oxygen gas or atmospheric air, the great bulk of the oxygen is converted into ozone.

In generating ozone from air, however, it requires to be carefully dried and likewise freed from carbonic acid before it is brought in contact with the electric current—which should be continuous—and thereby becomes ozonised, and is accomplished by passing same through caustic lime.

It will be found advantageous to cool the air before drying and sending it through the ozoniser, as heat has a considerable influence in the effective generation of ozone by this method.

Naturally the discharge of electricity in the apparatus produces some small degree of heating, the temperature usually reaching about 100° F., at which point, however, the efficiency of the apparatus is but feebly affected; but if run continuously this limit is liable to be exceeded, therefore it is advisable to adopt precautionary measures to keep the temperature as low as possible.

The quantity of oxygen contained in atmospheric air is about 21 per cent. of the volume, therefore the maximum ratio of ozone attainable, if the whole is converted, is some 14 per cent. In actual working, however, this quantity is never produced, but with an efficient apparatus it is possible to produce 10 per cent. ozone, but even if

only half of this quantity were made, the ozonised air would still possess powerful properties.

No bleaching agent for oils or fats is so good as ozonised air.

The temperatures at which the best results are obtained range as under :—

Lubricating oils and fats . . .	140° to 160° F.
Siccative oils	180° to 220° F.

India-rubber tubing or joints must be avoided, as ozone has a most rapid destructive action thereon.

Iron, tin, lead or zinc may be used for lining purposes, or coils, but not copper, as ozone has a strong corrosive action on the latter metal.

Bleaching Textile Fibres.

It is well known that all modern as well as the old air processes of bleaching ultimately resolve themselves into the destroying effect of oxygen on the colour of the unbleached fibre. Ozone ought to be much more effective, especially in the bleaching of wool and silk, and should prove a strong competitor of the articles now utilised in the bleaching of all kinds of textile fibres, as its application is very simple.

The fabric to be bleached is hung in a closed

chamber, and a current of ozone forced therein until the action of the gas has performed its allotted task.

No deleterious substances are formed during the process, which successfully completes the bleaching operation without rendering any further treatment necessary.

The benefits derivable from the usage of ozonised air for bleaching, purifying, deodorising, etc., must become a most important feature to manufacturers of glue, size, grease, tallow and oils, as it thereby enables them to manufacture without the necessity of having to resort to the direct use of mineral acids, which tend at all times to deteriorate rather than improve such articles.

The rapidity of action, combined with cheapness, accomplishable is also of material importance, and enhances their respective market value considerably.

The powerful oxidising properties, etc., of ozone must also render its use profitable to paint, colour and varnish manufacturers.

Bone grease, melted stuff and scutch grease, when acted upon by ozonised air, are sweetened, bleached and purified in a most beneficial way.

Edible cotton oils bleach rapidly under its influence, and are rendered practically tasteless.

Tallows and fats are rendered very sweet, and lose rapidly any rancidity or mustiness which they may contain.

Oxidation of oils, especially linseed, is most rapid and effective, the colour and extreme sweetness in every case being most pleasing.

The low cost of erecting such a plant and its simplicity, combined with cheapness and rapidity of action, should stimulate every manufacturer to its immediate adoption, and will repay for the outlay a hundredfold.

APPENDIX

OF

GENERAL INFORMATION.

Air and Gases.

Absolute zero by the different standard thermometrical scales :—

Fahrenheit - 459·4°, Centigrade - 273°, Raumer - 218·4°.

The volume occupied by the same weight of a perfect gas varies directly as its absolute temperature; in other words, the product of the pressure and volume is proportional to the absolute temperature, *i.e.*, it is always equal to the absolute temperature multiplied by a coefficient for each respective gas according to its density.

The following coefficients have been determined for 1 lb. gas :—

Gases.	Volume of 1 lb. Gas at 32° Fahr. under one atmosphere.	Coefficient when the pressure varies from 14·7 lb. per sq. inch.	Coefficient when the pressure is constant, *i.e.*, 14·7 lb. per sq. inch.
Hydrogen	178·83	5·33200	·362721
Gaseous steam	19·913	·59372	·040389
Nitrogen	12·723	·37937	·025807
Oxygen	11·205	·33406	·022725
Air	12·387	·36935	·025126

The coefficients are used as follows :—

To find the pressure of one pound of air of any volume and at any temperature :—

$$P = \frac{(T + 459{\cdot}4) \times {\cdot}36935}{V}.$$

To find the volume of one pound of air at any pressure and any temperature :—

$$V = \frac{(T + 459{\cdot}4) \times {\cdot}36935}{P}.$$

To find the volume of one pound of air at any temperature when the pressure is constant, *i.e.*, 14·7 lb. :—

$$V = (T + 459{\cdot}4) \times {\cdot}025126.$$

To find the temperature of one pound of air of any volume and pressure :—

$$T = \left(\frac{VP}{{\cdot}36935}\right) - 459{\cdot}4.$$

To find the weight in pounds per cubic foot of air at a given temperature and pressure :—

$$W = \frac{P}{(T + 459{\cdot}4) \times {\cdot}36935}.$$

One cubic foot of air at atmospheric pressure and at 62° F. weighs ·076097 lb. or 34·51704 grammes.

The volume of one pound of air under atmospheric pressure and 62° F. is 13·141 cubic feet.

The atmosphere is the gaseous envelope encircling the earth, the constant uniform pressure of which is 14·7 lb. per sq. inch, and is taken as unity, *i.e.*, one atmosphere, all increased pressure being a multiple thereof, and expressed in whole or part atmospheres.

PRESSURE OF AIR AT VARIOUS TEMPERATURES.

Temp. in Fahr. Degrees.	Pressure of a Given Weight of Air having a Constant Volume.		Temp. in Fahr. Degrees.	Pressure of a Given Weight of Air having a Constant Volume.	
	Pounds per sq. in.	Comparative Pressure.		Pounds per sq. in.	Comparative Pressure.
0	12·96	·881	95	15·63	1·063
5	13·10	·891	100	·77	·073
10	·24	·901	110	16·05	·092
15	·38	·910	120	·33	·111
20	·52	·920	130	·61	·130
25	·66	·929	140	·89	·149
30	·80	·939	150	17·17	·168
32	·86	·943	160	·46	·187
35	·94	·948	170	·74	·207
40	14·08	·958	180	18·02	·226
45	·22	·967	190	·30	·245
50	·36	·977	200	·58	·264
55	·50	·986	210	·86	·283
60	·64	·996	212	·92	·287
62	·70	1·000	220	19·14	·302
65	·78	·005	230	·42	·321
70	·92	·015	240	·70	·340
75	15·07	·025	250	·98	·359
80	·21	·034	260	20·27	·379
85	·35	·044	270	·55	·398
90	·49	·054	280	·83	·417

VOLUME AND WEIGHT OF AIR AT VARIOUS TEMPERATURES.

Temp. in Fahr. Degrees.	Volume of 1 lb. at a Constant Atmospheric Pressure of 14·7 lb. per sq. inch.		Weight of one cubic ft. at 14·7 lb. Pressure per sq. inch.	Temp. in Fahr. Degrees.	Volume of 1 lb. at a Constant Atmospheric Pressure of 14·7 lb. per sq. inch.		Weight of one cubic ft. at 14·7 lb. Pressure per sq. inch.
	Volume cu. feet.	Comparative Volume.			Volume cu. feet.	Comparative Volume.	
0	11·583	·881	·086331	90	·845	·054	·072230
5	·709	·891	·085402	95	·970	·063	·071580
10	·834	·901	·084500	100	14·096	·073	·070942
15	·960	·910	·083608	110	·346	·092	·069698
20	12·085	·920	·082745	120	·598	·111	·068500
25	·211	·929	·081894	130	·849	·130	·067342
30	·337	·939	·081055	140	15·100	·149	·066221
32	·387	·943	·080728	150	·352	·168	·065140
35	·462	·948	·080233	160	·603	·187	·064088
40	·588	·958	·079439	170	·854	·207	·063072
45	·714	·967	·078658	180	16·106	·226	·062090
50	·840	·977	·077884	190	·357	·245	·061134
55	·964	·987	·077133	200	·606	·264	·060210
60	13·090	·996	·076400	210	·860	·283	·059313
62	·141	1·000	·076097	212	·910	·287	·059135
65	·216	·006	·075667	220	17·111	·302	·058442
70	·342	·015	·074950	230	·362	·321	·057596
75	·467	·025	·074260	240	·612	·340	·056774
80	·593	·034	·073565	250	·865	·359	·055975
85	·718	·044	·072894	260	18·116	·379	·055200

FUEL.

The value of any fuel is measured by the number of heat units which its combustion will generate, a unit of heat being the amount required to heat 1 lb. of water 1° F. The fuel used in generating steam is composed of carbon and *hydrogen*, and ash, with sometimes small quan-

tities of other substances not materially affecting its value.

Average evaporative power :—

1 lb. coke evaporates 9 lb. water.
1 lb. coal „ 9 lb. „
1 ton coal „ 2,000 gallons.

"Combustible" is that portion which will burn; the ash or residue varying from 2 to 36 per cent. in different fuels.

TABLE OF COMBUSTIBLES.

KIND OF COMBUSTIBLE.	Air Required.	Temperature of Combustion.			
	In Pounds per pound of Combustible.	With Theoretical Supply of Air.	With 1½ Times the Theoretical Supply of Air.	With Twice the Theoretical Supply of Air.	With Three Times the Theoretical Supply of Air.
Hydrogen . . .	36·00	5750	3860	2860	1940
Petroleum . . .	15·43	5050	3515	2710	1850
Carbon—Charcoal, Coke, Anthracite Coal	12·13	4580	3215	2440	1650
Coal—Cumberland . .	12·06	4900	3360	2550	1730
„ Coking Bituminous	11·73	5140	3520	2680	1810
„ Cannel . . .	11·80	4850	3330	2540	1720
„ Lignite . . .	9·30	4600	3210	2490	1670
Peat—Kiln dried . .	7·68	4470	3140	2420	1660
„ Air dried 25 per cent. water .	5·76	4000	2820	2240	1550
Wood—Kiln dried . .	6·00	4080	2910	2260	1530
„ Air dried 20 per cent. water .	4·80	3700	2607	2100	1490

SAVING OF FUEL BY HEATING FEED-WATER. (IN PER CENT.—STEAM AT SIXTY POUNDS.)

Initial Tem. of Water.	FINAL TEMPERATURE OF FEED-WATER.						
	120°	140°	160°	180°	200°	250°	300°
32°	7·50	9·20	10·90	12·36	14·30	19·03	22·90
35	7·25	8·96	10·66	12·09	14·09	18·34	22·60
40	6·85	8·57	10·28	12·00	13·71	17·99	22·27
45	6·45	8·17	9·90	11·61	13·34	17·64	21·94
50	6·05	7·71	9·50	11·23	13·00	17·28	21·61
55	5·64	7·37	9·06	10·85	13·60	16·93	21·27
60	5·23	6·97	8·72	10·46	12·20	16·58	20·92
65	4·82	6·56	8·32	10·07	11·82	16·20	20·58
70	4·40	6·15	7·91	9·68	11·43	15·83	20·23
75	3·98	5·74	7·50	9·28	11·04	15·46	19·88
80	3·55	5·32	7·09	8·87	10·65	15·08	19·52
85	3·12	4·90	6·63	8·46	10·25	14·70	19·17
90	2·68	4·47	6·26	8·06	9·85	14·32	18·81
95	2·24	4·04	5·84	7·65	9·44	13·94	18·44
100	1·80	3·61	5·42	7·23	9·03	13·55	18·07
110	·90	2·73	4·55	6·38	8·20	12·76	17·28
120	0	1·84	3·67	5·52	7·36	11·95	16·49
130		·92	2·77	4·64	6·99	11·14	15·24
140		0	1·87	3·75	5·62	10·31	14·99
150			·94	2·83	4·72	9·46	14·18
160			0	1·91	3·82	8·59	13·37
170				·96	2·89	7·71	12·54
180				0	1·96	6·81	11·70
200					0	4·85	9·93

COAL.

The rate of combustion of coal in steam boilers per square foot of fire-grate per hour may be taken on the following basis :—

Portable engine boilers . . .	9 to 15 lb.
Vertical boilers	6 to 13 ,,
Cornish boilers	12 to 16 ,,
Lancashire boilers	14 to 28 ,,

Water at Different Temperatures.

There are four notable temperatures for pure water, *viz.*:—

1. Freezing point at sea level . . .	32° F.
2. Point of maximum density . . .	39·1° F.
3. British standard for specific gravity .	62° F.
4. Boiling point at sea level . . .	212° F.

32°	F.	Weight per cub. ft.	62·418	lb.;	per cub. in.,	·03612	lb.
39·1°	F.	,, ,, ,,	62·425	,,	,, ,,	·036125	,,
62°	F.	,, ,, ,,	62·355	,,	,, ,,	·03608	,,
212°	F.	,, ,, ,,	59·760	,,	,, ,,	·03458	,,

A British Imperial gallon holds 277·274 cubic inches and 10 lb. water at 62° F., which is equivalent to 0·16045 cubic feet.

Sea water (average) has a specific gravity of 1·028 boils at 213·2° F., and weighs 64 lb. per cubic foot at 62° F.

A pressure of 1 lb. per sq. in. is exerted by a column of water 2·3093 ft., or 27·71 in. high, at 62° F.

In solvent power water has a greater range than any other liquid. For common salt this is nearly constant at all temperatures, while it in-

creases with increase of temperature for others, magnesium and sodium sulphates, for instance.

Where water contains carbonic acid it dissolves some minerals quite readily, but a boiling temperature causes the disengagement of the carbonic acid in gaseous form and the deposition of a large part of the minerals thus held in solution.

Lime salts are more soluble in cold than in hot water, and most of them are deposited at 320°, or less. When frozen into ice, or evaporated into steam, water parts with nearly all substances held in solution.

TABLE OF SOLUBILITIES OF SCALE-MAKING MINERALS.

SUBSTANCE.	Soluble in parts of pure water at 32° F.	Soluble in parts carbonic acid water, cold.	Soluble in parts of pure water at 212°.	Insoluble in water at
Carbonate of Lime .	62,500	150	62,500	302° F.
Sulphate of Lime .	500	...	460	302 ,,
Carbonate of Magnesia .	5,500	150	9,600	...
Phosphate of Lime .	...	1,333	...	212 ,,
Oxide of Iron . .	...	...	...	212 ,,
Silica	...	Und't'd	...	212 ,,

Water has a greater specific heat, or heat-absorbing capacity, than any other known substance (bromine and hydrogen excepted), and is the unit of comparison employed for all measure-

ments of the capacities for heat of all substances whatever. The specific heat of water is not constant, but rises in an increasing ratio with the temperature, so that it requires slightly more heat, the higher the temperature, to raise a given quantity of water from one temperature to another. The specific heat of ice and steam are, respectively, ·504 and ·475, or practically about half that of water.

A British Thermal Unit (or heat unit) is that quantity of heat which will raise 1 lb. of water at or about freezing point, 1° F. A French "Calorie" is the heat required to raise one kilogramme of water 1° C., and is equal to 3·96832 British thermal units.

The following table gives the number of British thermal units in a pound of water at different temperatures. They are reckoned above 32° F., for, strictly speaking, *water* does not exist below 32°, and ice follows another law.

Water between 32° and 212° F.

Temperature Fahr.	Heat Units per lb.	Weight, lb. per cub. ft.	Temperature Fahr.	Heat Units per lb.	Weight, lb. per cub. ft.
32°	0·00	62·42	110°	78·00	61·89
35	3·02	62·42	112	80·00	61·86
40	8·06	62·42	113	81·01	61·84
45	13·08	62·42	114	82·02	61·83
50	18·10	62·41	115	83·02	61·82
52	20·11	62·40	116	84·03	61·80
54	22·11	62·40	117	85·04	61·78
56	24·11	62·39	118	86·05	61·77
58	26·12	62·38	119	87·06	61·75
60	28·12	62·37	120	88·06	61·74
62	30·12	62·36	121	89·07	61·72
64	32·12	62·35	122	90 08	61·70
66	34·12	62·34	123	91·09	61·68
68	36·12	62·33	124	92·10	61·67
70	38·11	62·31	125	93·10	61·65
72	40·11	62·30	126	94·11	61·63
74	42·11	62·28	127	95·12	61·61
76	44·11	62·27	128	96·13	61·60
78	46·10	62·25	129	97·14	61·58
80	48·09	62·23	130	98·14	61·56
82	50·08	62·21	131	99·15	61·54
84	52·07	62·19	132	100·16	61·52
86	54·06	62·17	133	101·17	61·51
88	56·05	62·15	134	102·18	61·49
90	58·04	62·13	135	103·18	61·47
92	60·03	62·11	136	104·19	61·45
94	62·02	62·09	137	105·20	61·43
96	64·01	62·07	138	106·21	61·41
98	66·01	62·05	139	107·22	61·39
100	68·01	62·02	140	108·22	61·37
102	70·00	62·00	141	109·23	61·36
104	72·00	61·97	142	110·24	61·34
106	74·00	61·95	143	111·25	61·32
108	76·00	61·92	144	112·26	61·30

WATER BETWEEN 32° AND 212° F.—*continued.*

Temperature Fahr.	Heat Units per lb.	Weight, lb. per cub. ft.	Temperature Fahr.	Heat Units per lb.	Weight, lb. per cub. ft.
145°	113·26	61·28	179°	147·54	60·57
146	114·27	61·26	180	148·54	60·55
147	115·28	61·24	181	149·55	60·53
148	116·29	61·22	182	150·56	60·50
149	117·30	61·20	183	151·57	60·48
150	118·30	61·18	184	152·58	60·46
151	119·31	61·16	185	153·58	60·44
152	120·32	61·14	186	154·59	60·41
153	121·33	61·12	187	155·60	60·39
154	122·34	61·10	188	156·61	60·37
155	123·34	61·08	189	157·62	60·34
156	124·35	61·06	190	158·62	60·32
157	125·36	61·04	191	159·63	60·29
158	126·37	61·02	192	160·63	60·27
159	127·38	61·00	193	161·64	60·25
160	128·38	60·98	194	162·65	60·22
161	129·39	60·96	195	163·66	60·20
162	130·40	60·94	196	164·66	60·17
163	131·41	60·92	197	165·67	60·15
164	132·42	60·90	198	166·68	60·12
165	133·42	60·87	199	167·69	60·10
166	134·43	60·85	200	168·70	60·07
167	135·44	60·83	201	169·70	60·05
168	136·45	60·81	202	170·71	60·02
169	137·46	60·79	203	171·72	60·00
170	138·46	60·77	204	172·73	59·97
171	139·47	60·75	205	173·74	59·95
172	140·48	60·73	206	174·74	59·92
173	141·49	60·70	207	175·75	59·89
174	142·50	60·68	208	176·76	59·87
175	143·50	60·66	209	177·77	59·84
176	144·51	60·64	210	178·78	59·82
177	145·52	60·62	211	179·78	59·79
178	146·53	60·59	212	180·79	59·76

HEAD OF WATER AND EQUIVALENT PRESSURE IN POUNDS PER SQUARE INCH.

Head in Feet.	Pressure.	Head in Feet.	Pressure.	Head in Feet.	Pressure.	Head in Feet.	Pressure.
1	0·43	21	9·09	41	·75	61	26·42
2	0·86	22	·53	42	18·19	62	·85
3	1·30	23	·96	43	·62	63	27·29
4	·73	24	10·39	44	19·05	64	·72
5	2·16	25	·82	45	·49	65	28·15
6	·59	26	11·26	46	·92	66	·58
7	3·03	27	·69	47	20·35	67	29·02
8	·46	28	12·12	48	·79	68	·45
9	·89	29	·55	49	21·22	69	·88
10	4·33	30	·99	50	·65	70	30·32
1	·76	31	13·42	51	22·09	71	·75
2	5·20	32	·86	52	·52	72	31·18
3	·63	33	14·29	53	·95	73	·62
4	6·06	34	·72	54	23·39	74	32·05
5	·49	35	15·16	55	·82	75	·48
6	·93	36	·59	56	24·26	76	·92
7	7·36	37	16·02	57	·69	77	33·35
8	·79	38	·45	58	25·12	78	·78
9	8·22	39	·89	59	·55	79	34·21
20	·66	40	17·32	60	·99	80	·65

Properties of Saturated Steam.

Total Pressure per square inch, lb.	Temp. of Steam and Water in Fahr. Degrees.	Number of Thermal Units contained in one pound calculated from Fahr.			Weight of one cubic foot.		Volume of one pound of Steam, cu. feet.	Cubic feet of Steam from one cubic foot of Water at 62° F.
		Number contained in the Water.	Number required for Evaporation, i.e., Latent Heat.	Total Number contained in the Steam.	Steam, lb.	Water, lb.		
15	213·1	214·1	964·3	1178·4	·0387	59·722	25·85	1611
6	216·3	217·3	962·1	1179·4	·0411	·639	24·32	1516
7	219·6	220·5	959·8	1180·3	·0435	·550	22·96	1432
8	222·4	223·5	957·7	1181·2	·0459	·476	21·78	1357
9	225·3	226·4	955·7	1182·1	·0483	·397	20·70	1290
20	228·0	230·1	952·8	·9	·0507	·325	19·72	1229
1	230·6	232·4	951·3	1183·7	·0531	·253	18·84	1174
2	233·1	234·6	949·9	1184·5	·0555	·186	·03	1123
3	235·5	236·7	948·5	1185·2	·0580	·119	17·26	1075
4	237·8	239·0	946·9	·9	·0601	·054	16·64	1036
5	240·1	241·3	945·3	1186·6	·0625	58·990	15·99	996
6	242·3	243·6	943·7	1187·3	·0650	·928	·38	958
7	244·4	245·6	942·2	·8	·0673	·870	14·86	926
8	246·4	247·6	940·8	1188·4	·0696	·814	·37	895
9	248·4	249·7	939·4	1189·1	·0719	·757	13·90	866
30	250·4	250·9	937·9	·8	·0743	·699	·46	838
1	252·2	253·7	936·7	1190·4	·0766	·647	·05	813
2	254·1	255·6	935·3	·9	·0789	·592	12·67	789
3	255·9	257·5	934·0	1191·5	·0812	·540	·31	767
4	257·6	259·2	932·8	1192·0	·0835	·491	11·97	746
5	259·3	260·9	931·6	·5	·0858	·441	·65	726
6	260·9	262·5	930·5	1193·0	·0881	·395	·34	707
7	262·6	264·2	929·3	·5	·0905	·346	·04	688
8	264·2	265·8	928·2	1194·0	·0929	·299	10·76	671
9	265·8	267·4	927·1	·5	·0952	·253	·51	655
40	267·3	268·9	926·0	·9	·0974	·207	·27	640
1	268·7	270·5	924·9	1195·4	·0996	·166	·03	625
2	270·2	271·9	923·9	·8	·1020	·121	9·81	611
3	271·6	273·3	922·9	1196·2	·1042	·079	·59	598
4	273·0	274·7	921·9	·6	·1065	·037	·39	585
5	274·4	276·2	920·9	1197·1	·1089	57·995	·18	572
6	275·8	277·6	919·9	·5	·1111	·953	·00	561

PROPERTIES OF SATURATED STEAM—*continued.*

Total Pressure per square inch, lb.	Temp. of Steam and Water in Fahr. Degrees.	Number of Thermal Units contained in one pound calculated from Fahr.			Weight of one cubic foot.		Volume of one pound of Steam, cu. feet.	Cubic feet of Steam from one cubic foot of Water at 62° F.
		Number contained in the Water.	Number required for Evaporation, *i.e.*, Latent Heat.	Total Number contained in the Steam.	Steam, lb.	Water, lb.		
47	277·1	278·9	919·0	·9	·1133	·914	8·82	550
8	278·4	280·2	918·1	1198·3	·1156	·875	·65	539
9	279·7	281·5	917·2	·7	·1179	·836	·48	529
50	281·0	282·8	916·3	1199·1	·1202	·797	·31	518
1	282·3	284·1	915·4	·5	·1224	·758	·17	509
2	283·5	285·4	914·5	·9	·1246	·722	·04	500
3	284·7	286·7	913·6	1200·3	·1269	·686	7·88	491
4	285·9	287·8	912·8	·6	·1291	·650	·74	482
5	287·1	289·0	912·0	1201·0	·1314	·613	·61	474
6	288·2	290·1	911·2	·3	·1336	·579	·48	466
7	289·3	291·3	910·4	·7	·1364	·545	·36	458
8	290·4	292·4	909·6	1202·0	·1380	·511	·24	451
9	291·6	293·6	908·8	·4	·1403	·473	·12	444
60	292·7	294·7	908·0	·7	·1425	·439	·01	437
1	293·8	295·9	907·2	1203·1	·1447	·405	6·90	430
2	294·8	297·0	906·4	·4	·1469	·374	·81	424
3	295·9	298·1	905·6	·7	·1493	·340	·70	417
4	296·9	299·1	904·9	1204·0	·1516	·309	·60	411
5	298·0	300·1	904·2	·3	·1538	·275	·49	405
6	299·0	301·1	903·5	·6	·1560	·244	·41	399
7	300·0	302·1	902·8	·9	·1583	·213	·32	393
8	300·9	303·1	902·1	1205·2	·1605	·185	·23	388
9	301·9	304·1	901·4	·5	·1627	·154	·15	383
70	302·9	305·0	900·8	·8	·1648	·123	·09	378
1	303·9	305·8	900·3	1206·1	·1670	·092	5·99	373
2	304·8	306·7	899·6	·3	·1692	·064	·91	368
3	305·7	307·7	898·9	·6	·1714	·036	·83	363
4	306·6	308·7	898·2	·9	·1736	·008	·76	358
5	307·5	309·7	897·5	1207·2	·1759	56·980	·68	353
6	308·4	310·6	896·8	·4	·1782	·953	·61	349
7	309·3	311·6	896·1	·7	·1804	·925	·54	345
8	310·2	312·5	895·5	1208·0	·1826	·897	·48	341

PROPERTIES OF SATURATED STEAM—*continued.*

Total Pressure per square inch, lb.	Temp. of Steam and Water in Fahr. Degrees.	Number of Thermal Units contained in one pound calculated from Fahr.			Weight of one cubic foot.		Volume of one pound of Steam, cu. feet.	Cubic feet of Steam from one cubic foot of Water at 62° F.
		Number contained in the Water.	Number required for Evaporation, i.e., Latent Heat.	Total Number contained in the Steam.	Steam, lb.	Water, lb.		
79	311·1	313·4	894·9	·3	·1848	·868	·41	337
80	312·0	314·2	894·3	·5	·1869	·839	·35	333
1	312·8	315·1	893·7	·8	·1891	·813	·29	329
2	313·6	316·0	893·1	1209·1	·1913	·788	·23	325
3	314·5	316·9	892·5	·4	·1935	·759	·17	321
4	315·3	317·6	892·0	·6	·1957	·733	·11	318
5	316·1	318·5	891·4	·9	·1980	·708	·05	314
6	316·9	319·3	890·8	1210·1	·2002	·682	·00	311
7	317·8	320·2	890·2	·4	·2024	·653	4·94	308
8	318·6	321·0	889·6	·6	·2044	·628	·89	305
9	319·4	321·9	889·0	·9	·2067	·602	·84	301
90	320·2	322·6	888·5	1211·1	·2089	·577	·79	298
1	321·0	323·4	887·9	·3	·2111	·551	·74	295
2	321·7	324·2	887·3	·5	·2133	·529	·69	292
3	322·5	325·0	886·8	·8	·2155	·503	·64	289
4	323·3	325·7	886·3	1212·0	·2176	·477	·60	286
5	324·1	326·5	885·8	·3	·2198	·452	·55	283
6	324·8	327·3	885·2	·5	·2219	·430	·51	281
7	325·6	328·2	884·6	·8	·2241	·404	·46	278
8	326·3	328·9	884·1	1213·0	·2263	·381	·42	275
9	327·1	329·6	883·6	·2	·2285	·356	·37	272
100	327·9	330·3	883·1	·4	·2307	·330	·33	270

737168

VOLUME OF THE FLOW OF STEAM INTO THE ATMOSPHERE.

Pressure, lb. per sq. inch.	Velocity per second, feet.	Velocity per minute, feet.	Pressure lb. per sq. inch.	Velocity per second, feet.	Velocity per minute, feet.
1	482	28920	30	1643	97580
5	973	58380	50	1791	107460
10	1241	74460	70	1877	112620
20	1504	90240	100	1957	117420

For each nominal horse-power a boiler requires :—

1 cubic foot of water per hour.
1 square yard of heating surface.
1 square foot of fire-grate surface.
1 cube yard capacity.

To Heat Rooms.—One square foot of steam pipe surface is required for 80 cubic feet of space ; 1 cubic foot of boiler is required for 1500 cubic feet of space ; 1 horse-power boiler is sufficient for 40,000 cubic feet of space.

To find the Area of a Circle when the Radius is known.—Square the radius, multiply by 22 and divide the result by 7.

To find the Circumference.—Multiply the diameter by 22 and divide by 7.

To find the Radius when the Circumference is known. — Multiply the circumference by 7 and divide by 44.

Rules for finding the horse-power nominal of *boilers* :—

1. *Plain Cylindrical Boilers.* — Multiply the length by the diameter and divide by 6.

2. *Single Flue Boilers.*—Add the diameter of shell and flue, multiply by the length, and divide the result by 7.

3. *Double Flue Boilers.*—Add the three diameters of shell and flue tubes, multiply by the length, and divide the result by 8.

A horse-power in a steam-engine or other prime mover, is 50 lb. raised 1 ft. per second, or 33,000 lb. 1 ft. per minute.

Temperature of steam :—

PRESSURE IN LB. PER SQUARE INCH (INCLUDING ATMOSPHERE).

15 lb.	212° F.
20 ,,	228°
25 ,,	240°
30 ,,	250°
40 ,,	267°
50 ,,	274°
60 ,,	293°
70 ,,	303°
80 ,,	312°
90 ,,	320°
100 ,,	327°
120 ,,	341°
140 ,,	353°
160 ,,	363°
180 ,,	373°
200 ,,	382°

Equivalent pressure of water tables, 76.
Evaporation of liquors, 23.
Extraction of gelatinous matter, 47.
— of matter from bones, 23.
Extraction of dyes, 3.

F.

Fabrics, washing and dyeing, 23.
Fats, clarification of, 16.
— washing and clarifying of, 3.
Fleshings, 44.
Flow of steam, volume of, 80.
Flushing of water filters, 42.
Fuel, value of, 68.

G.

Gases, table, 65.
Gelatine and glue drying, 45.
Gelatinous group, 50.
General information, 65.
Glue and gelatine drying, 45.
Glue bleaching, 45.
Greases, rapid cooling of, 23.

H.

Hardness of water, 32, 42.
Head of water tables, 76.
Heating feed water, 70.
— rooms by steam, 80.
Heat units, 73.

K.

Korting's apparatus, 18.

L.

Lifting of liquids, 11.
Lime and alumina, 39.
Liquid air, 28.
Liquids, lifting of, 11.
Lixiviation of lye, 3.

M.

Manufacture of colours, 3.
Melting by hot air, 16.
Mixing by air, 16.
— of liquids, 23.

N.

Noxious fumes, carrying away, 5.

O.

Oil tanks, keeping warm, 16.
Oils and fats, clarification of, 23.
— clarification of, 16.
— cooling by air, 17.
— oxidation of, 23.
— thickening and drying, 17.
— washing and clarifying of, 3.
Oxidation of oils, 23.
Ozone, 52.
— detection of, 54.
— definition of, 54.
— from electricity, production, 59.
— production of, 55.
Ozonised air, 52.

P.

Paint spraying, 25, 26.
Palm oil bleaching, 18.
Pans and coppers, 5.
Plant for making ozone, 56.
Preparing blown oils, 20, 24.
— siccative drying oils, 21.
Pressure, 17.
— of air, 67.
Production of ozone, 55.
— — — from electricity, 59.
Properties of saturated steam, 77.
Purification of water, 31.

R.

Radius of a circle, 80.
Raising of acids, 25, 26.
Resin and tar distillation, 3.
Retrocession method, 29.

S.

Saturated steam, properties of, 77.
Saturation of solids, 23.
Saving of fuel, 70.
Scale in boilers, 33.
— making minerals, solubility, 72.
— preventive, 34.
Siccative drying oils, preparing, 21.
Simmering of bones, 3.
Single flue boilers, horse power of, 81.
Size, evaporation of, 23.
Sizes of ejectors, 5.
Soap boiling, use of air in, 3.
— solution, 42.
Softening of water, 3.
— water, 34.
Solids, saturation of, 23.
— treatment of, 24.
Solubilities of scale-making minerals, 72.
Standard soap solution, 42.
Steam temperature, 81.
Suction process, 18.
Sulphate of alumina, use in water purification, 38.

T.

Tallows, cooling of, 23.
Temperature of steam, 81.
Temperatures of water, 71.
Testing water, 36.
Textile fibres, bleaching, 61.
Thermal units, 73.
Thickening oils, 17.

U.

Use of steam and air, 4.
Uses of atmospheric air, 1.

V.

Vacuum, 17.
Vats and pans, 5.
Ventilation, 25, 26.
Volume of air table, 68.
— of the flow of steam at various pressures, 80.

W.

Washing fabrics, 23.
— oils and fats, 3.
Water at different temperatures, 71.
— hardness, 42.
— purification, 31.
— — mixture, 35.
Weight of air tables, 68.
Wet method of using air, 2.
Whitewash, 27.
Whitewashing, 25, 26.

X.

XL ejector, 2, 26.

ABERDEEN
UNIVERSITY
PRESS

Catalogue

OF

pecial Technical Works

FOR

MANUFACTURERS, STUDENTS, AND TECHNICAL SCHOOLS

BY EXPERT WRITERS

INDEX TO SUBJECTS.

	PAGE
ltural Chemistry	10
dustrial Use of	11
nd its Sulphates	9
nia	9
Colours	3
Fats	6
rrosive Paints	4
ecture, Terms in	30
ectural Pottery	16
ial Perfumes	7
as	10
graphy	32
ing	23
Products	8
inding	31
naking	15, 16
hing Brass	28
Yarn Printing	21
ic Books	14, 15
al	8
cal Essays	9
try of Pottery	17
try of Dye-stuffs	23
nalysis	16
ist Firing	26
Matching	21
y Recovery Work	25
-mixing for Dyers	21
Theory	22
ng Machines	24
unding Oils	6
nsing Apparatus	26
tics	7
Dyeing	22
Spinning	24
k Weaving	20
ess in Buildings	30
ators' Books	28
ative Textiles	20
Metallurgy	27
aryof Paint Materials	3
Oils	5
with Air	11
Marble	31
Woollen Fabrics	22
Dyers' Materials	21
Dye-stuffs	23
Enamelling Metal	18
Enamels	18
Engraving	31
Essential Oils	7
Evaporating Apparatus	26
External Plumbing	27
Fats	5, 6
Faults in Woollen Goods	20
Gas Firing	26
Glass-making Recipes	17
Glass Painting	17
Glue Making and Testing	8
Greases	5
History of Staffs Potteries	16
Hops	28
Hot-water Supply	28
How to make a Woollen Mill Pay	21
India-rubber	13
Inks	3, 11
Iron-corrosion	4
Iron, Science of	26
Japanning	28
Lacquering	28
Lake Pigments	3
Lead and its Compounds	11
Leather Industry	13
Leather-working Materials	14
Lithography	31
Lubricants	5, 6
Manures	8, 10
Mineral Pigments	2
Mine Ventilation	25
Mine Haulage	25
Oil and Colour Recipes	3
Oil Boiling	4
Oil Merchants' Manual	7
Oils	5
Ozone, Industrial Use of	12
Paint Manufacture	2
Paint Materials	3
Paint-material Testing	4
Paper-pulp Dyeing	18
Petroleum	6
Pigments, Chemistry of	2
Plumbers' Work	27
Porcelain Painting	18
Pottery Clays	16
Pottery Manufacture	14
Power-loom Weaving	19
Preserved Foods	30
Printers' Ready Reckoner	31
Printing Inks	3
Recipes for Oilmen, etc.	3
Resins	10
Risks of Occupations	12
Rivetting China, etc.	16
Sanitary Plumbing	28
Scheele's Essays	9
Sealing Waxes	11
Silk Dyeing	23
Silk Throwing	19
Smoke Prevention	25
Soaps	7, 32
Spinning	20
Staining Marble, and Bone	31
Steam Drying	11
Sugar Refining	32
Steel Hardening	26
Sweetmeats	30
Terra-cotta	16
Testing Paint Materials	4
Testing Yarns	20
Textile Fabrics	20
Textile Materials	19, 20
Timber	29
Varnishes	4
Vegetable Fats	7
Waste Utilisation	10
Water, Industrial Use	12
Waterproofing Fabrics	21
Weaving Calculations	20
Wood Waste Utilisation	29
Wood Dyeing	31
Wool Dyeing	22
Writing Inks	11
X-Ray Work	13
Yarn Testing	20

PUBLISHED BY

COTT, GREENWOOD & CO.,

19 LUDGATE HILL, LONDON, E.C.

ldress: "PRINTERIES, LONDON". Tel. No. 2403, Bar

Paints, Colours and Printing Inks.

THE CHEMISTRY OF PIGMENTS. By ERNEST J. PARRY, B.Sc. (Lond.), F.I.C., F.C.S., and J. H. COSTE, F.I.C., F.C.S. Demy 8vo. Five Illustrations. 285 pp. 1902. Price 10s. 6d.; India and Colonies, 11s.; Other Countries, 12s.; strictly net.

Contents.

Introductory. Light—White Light—The Spectrum—The Invisible Spectrum—Normal Spectrum—Simple Nature of Pure Spectral Colour—The Recomposition of White Light—Primary and Complementary Colours—Coloured Bodies—Absorption Spectra—**The Application of Pigments.** Uses of Pigments: Artistic, Decorative, Protective—Methods of Application of Pigments: Pastels and Crayons, Water Colour, Tempera Painting, Fresco, Encaustic Painting, Oil-colour Painting, Keramic Art, Enamel, Stained and Painted Glass, Mosaic—**Inorganic Pigments.** White Lead—Zinc White—Enamel White—Whitening—Red Lead—Litharge—Vermilion—Royal Scarlet—The Chromium Greens—Chromates of Lead, Zinc, Silver and Mercury—Brunswick Green—The Ochres—Indian Red—Venetian Red—Siennas and Umbers—Light Red—Cappagh Brown—Red Oxides—Mars Colours—Terre Verte—Prussian Brown—Cobalt Colours—Cœruleum—Smalt—Copper Pigments—Malachite—Bremen Green—Scheele's Green—Emerald Green—Verdigris—Brunswick Green—Non-arsenical Greens—Copper Blues—Ultramarine—Carbon Pigments—Ivory Black—Lamp-Black—Bistre—Naples Yellow—Arsenic Sulphides: Orpiment, Realgar—Cadmium Yellow—Vandyck Brown—**Organic Pigments.** Prussian Blue—Natural Lakes—Cochineal—Carmine—Crimson—Lac Dye—Scarlet—Madder—Alizarin—Campeachy—Quercitron—Rhamnus—Brazil Wood—Alkanet—Santal Wood—Archil—Coal-tar Lakes—Red Lakes—Alizarin Compounds—Orange and Yellow Lakes—Green and Blue Lakes—Indigo—Dragon's Blood—Gamboge—Sepia—Indian Yellow, Puree—Bitumen. Asphaltum, Mummy—**Index.**

THE MANUFACTURE OF PAINT. A Practical Handbook for Paint Manufacturers, Merchants and Painters. By J. CRUICKSHANK SMITH, B.Sc. Demy 8vo. 1901. 200 pp. Sixty Illustrations and One Large Diagram. Price 7s. 6d.; India and Colonies, 8s.; Other Countries, 8s. 6d.; strictly net.

Contents.

Preparation of Raw Material—Storing of Raw Material—Testing and Valuation of Raw Material—Paint Plant and Machinery—The Grinding of White Lead—Grinding of White Zinc—Grinding of other White Pigments—Grinding of Oxide Paints—Grinding of Staining Colours—Grinding of Black Paints—Grinding of Chemical Colours—Yellows—Grinding of Chemical Colours—Blues—Grinding Greens—Grinding Reds—Grinding Lakes—Grinding Colours in Water—Grinding Colours in Turpentine—The Uses of Paint—Testing and Matching Paints—Economic Considerations—Index.

THE MANUFACTURE OF MINERAL AND LAKE PIGMENTS. Containing Directions for the Manufacture of all Artificial, Artists and Painters' Colours, Enamel, Soot and Metallic Pigments. A Text-book for Manufacturers, Merchants, Artists and Painters. By Dr. JOSEF BERSCH. Translated by A. C. WRIGHT, M.A. (Oxon.), B.Sc. (Lond.). Forty-three Illustrations. 476 pp., demy 8vo. 1901. Price 12s. 6d.; India and Colonies 13s. 6d.; Other Countries, 15s.; strictly net.

Contents.

Introduction—Physico-chemical Behaviour of Pigments—Raw Materials Employed in the Manufacture of Pigments—Assistant Materials—Metallic Compounds—The Manufacture of Mineral Pigments—The Manufacture of White Lead—Enamel White—Washing Apparatus—Zinc White—Yellow Mineral Pigments—Chrome Yellow—Lead Oxide Pigments—Other Yellow Pigments—Mosaic Gold—Red Mineral Pigments—The Manufacture of Vermilion—Antimony Vermilion—Ferric Oxide Pigments—Other Red Mineral Pigments—Purple of Cassius—Blue Mineral Pigments—Ultramarine—Manufacture of Ultramarine—Blue Copper Pigments—Blue Cobalt Pigments—Smalts—Green Mineral Pigments—Emerald Green—*Verdigris*—*Chromium* Oxide—Other Green Chromium Pigments—Green Cobalt Pigments—*Green Manganese* Pigments—Compounded Green Pigments—Violet Mineral Pigments—*Brown Mineral* Pigments—Brown Decomposition Products—Black Pigments—Manufacture of So[illegible]nts—Manufacture of Lamp Black—The Manufacture of Soot Black

without Chambers—Indian Ink—Enamel Colours—Metallic Pigments—Bronze Pigments—Vegetable Bronze Pigments.

PIGMENTS OF ORGANIC ORIGIN—Lakes—Yellow Lakes—Red Lakes—Manufacture of Carmine—The Colouring Matter of Lac—Safflower or Carthamine Red—Madder and its Colouring Matters—Madder Lakes—Manjit (Indian Madder)—Lichen Colouring Matters—Red Wood Lakes—The Colouring Matters of Sandal Wood and Other Dye Woods—Blue Lakes—Indigo Carmine—The Colouring Matter of Log Wood—Green Lakes—Brown Organic Pigments—Sap Colours—Water Colours—Crayons—Confectionery Colours—The Preparation of Pigments for Painting—The Examination of Pigments—Examination of Lakes—The Testing of Dye-Woods—The Design of a Colour Works—Commercial Names of Pigments—Appendix: Conversion of Metric to English Weights and Measures—Centigrade and Fahrenheit Thermometer Scales—Index.

DICTIONARY OF CHEMICALS AND RAW PRODUCTS USED IN THE MANUFACTURE OF PAINTS, COLOURS, VARNISHES AND ALLIED PREPARATIONS. By GEORGE H. HURST, F.C.S. Demy 8vo. 380 pp. 1901. Price 7s. 6d.; India and Colonies, 8s.; Other Countries, 8s. 6d.; strictly net.

THE MANUFACTURE OF LAKE PIGMENTS FROM ARTIFICIAL COLOURS. By FRANCIS H. JENNISON, F.I.C., F.C.S. **Sixteen Coloured Plates, showing Specimens of Eighty-nine Colours, specially prepared from the Recipes given in the Book.** 136 pp. Demy 8vo. 1900. Price 7s. 6d.; India and Colonies, 8s.; Other Countries, 8s. 6d.; strictly net.

Contents.

The Groups of the Artificial Colouring Matters—The Nature and Manipulation of Artificial Colours—Lake-forming Bodies for Acid Colours—Lake-forming Bodies' Basic Colours—Lake Bases—The Principles of Lake Formation—Red Lakes—Orange, Yellow, Green, Blue, Violet and Black Lakes—The Production of Insoluble Azo Colours in the Form of Pigments—The General Properties of Lakes Produced from Artificial Colours—Washing, Filtering and Finishing—Matching and Testing Lake Pigments—Index.

RECIPES FOR THE COLOUR, PAINT, VARNISH, OIL, SOAP AND DRYSALTERY TRADES. Compiled by AN ANALYTICAL CHEMIST. 350 pp. 1902. Demy 8vo. Price 7s. 6d.; India and British Colonies, 8s.; Other Countries, 8s. 6d.; strictly net.

Contents.

Pigments or Colours for Paints, Lithographic and Letterpress Printing Inks, etc.—Mixed Paints and Preparations for Paint-making, Painting, Lime-washing, Paperhanging, etc.—Varnishes for Coach-builders, Cabinetmakers, Wood-workers, Metal-workers, Photographers, etc.—Soaps for Toilet, Cleansing, Polishing, etc.—Perfumes—Lubricating Greases, Oils, etc.—Cements, Pastes, Glues and Other Adhesive Preparations—Writing, Marking, Endorsing and Other Inks—Sealing-wax and Office Requisites—Preparations for the Laundry, Kitchen, Stable and General Household Uses—Disinfectant Preparations—Miscellaneous Preparations—Index.

OIL COLOURS AND PRINTING INKS. By LOUIS EDGAR ANDÉS. Translated from the German. 215 pp. Crown 8vo. 56 Illustrations. 1903. Price 5s.; India and British Colonies, 5s. 6d.; Other Countries, 6s.; strictly Net.

Contents.

Linseed Oil—Poppy Oil—Mechanical Purification of Linseed Oil—Chemical Purification of Linseed Oil—Bleaching Linseed Oil—Oxidizing Agents for Boiling Linseed Oil—Theory of Oil Boiling—Manufacture of Boiled Oil—Adulterations of Boiled Oil—Chinese Drying Oil and Other Specialities—Pigments for House and Artistic Painting and Inks—Pigment for Printers' Black Inks—Substitutes for Lampblack—Machinery for Colour Grinding and Rubbing—Machines for mixing Pigments with the Vehicle—Paint Mills—Manufacture of *House Oil Paints*—*Ship* Paints—Luminous Paint—Artists' Colours—Printers' Inks—VEHICLES—*Printers' Inks*:—PIGMENTS and MANUFACTURE.—Index.

(*See also Writing* Inks, p. 11.)

SIMPLE METHODS FOR TESTING PAINTERS' MATERIALS. By A. C. Wright, M.A. (Oxon.), B.Sc. (Lond.). Crown 8vo. 160 pp. 1903. Price 5s.; India and British Colonies, 5s. 6d.; Other Countries, 6s.; strictly Net.

Contents.

Necessity for Testing—Standards—Arrangement—The Apparatus—The Reagents—Practical Tests—Dry Colours—Stiff Paints—Liquid and Enamel Paints—Oil Varnishes—Spirit Varnishes—Driers—Putty—Linseed Oil—Turpentine—Water Stains—The Chemical Examination—Dry Colours and Paints—White Pigments and Paints—Yellow Pigments and Paints—Blue Pigments and Paints—Green Pigments and Paints—Red Pigments and Paints—Brown Pigments and Paints—Black Pigments and Paints—Oil Varnishes—Linseed Oil—Turpentine.

IRON-CORROSION, ANTI-FOULING AND ANTI-CORROSIVE PAINTS. Translated from the German of Louis Edgar Andés. Sixty-two Illustrations. 275 pp. Demy 8vo. 1900. Price 10s. 6d.; India and Colonies, 11s.; Other Countries, 12s.; strictly net.

Contents.

Iron-rust and its Formation—Protection from Rusting by Paint—Grounding the Iron with Linseed Oil, etc.—Testing Paints—Use of Tar for Painting on Iron—Anti-corrosive Paints—Linseed Varnish—Chinese Wood Oil—Lead Pigments—Iron Pigments—Artificial Iron Oxides—Carbon—Preparation of Anti-corrosive Paints—Results of Examination of Several Anti-corrosive Paints—Paints for Ship's Bottoms—Anti-fouling Compositions—Various Anti-corrosive and Ship's Paints—Official Standard Specifications for Ironwork Paints—Index.

THE TESTING AND VALUATION OF RAW MATERIALS USED IN PAINT AND COLOUR MANUFACTURE. By M. W. Jones, F.C.S. A Book for the Laboratories of Colour Works. 88 pp. Crown 8vo. 1900. Price 5s.; India and Colonies, 5s. 6d.; Other Countries, 6s.; strictly net.

Contents.

Aluminium Compounds—China Clay—Iron Compounds—Potassium Compounds—Sodium Compounds—Ammonium Hydrate—Acids—Chromium Compounds—Tin Compounds—Copper Compounds—Lead Compounds—Zinc Compounds—Manganese Compounds—Arsenic Compounds—Antimony Compounds—Calcium Compounds—Barium Compounds—Cadmium Compounds—Mercury Compounds—Ultramarine—Cobalt and Carbon Compounds—Oils—Index.

STUDENTS' MANUAL OF PAINTS, COLOURS, OILS AND VARNISHES. By John Furnell. Crown 8vo. 12 Illustrations. 96 pp. 1903. Price 2s. 6d.; Abroad, 3s.; strictly net.

Contents.

Plant—Chromes—Blues—Greens—Earth Colours—Blacks—Reds—Lakes—Whites—Painters' Oils—Turpentine—Oil Varnishes—Spirit Varnishes—Liquid Paints—Enamel Paints.

Varnishes and Drying Oils.

THE MANUFACTURE OF VARNISHES, OIL REFINING AND BOILING, AND KINDRED INDUSTRIES. Translated from the French of Ach. Livache, Ingénieur Civil des Mines. Greatly Extended and Adapted to English Practice, with numerous Original Recipes by John Geddes McIntosh. 27 Illustrations. 400 pp. Demy 8vo. 1899. *Price 12s. 6d.*; India and Colonies, 13s. 6d.; Other Countries, 15s.; *strictly net.*

Contents.

Resins—Solvents: Natural, Artificial, Manufacture, Storage, Special Use—Colouring Principles, Vegetable, Coal Tar, Coloured Resinates, Coloured Oleates and Linoleates—Gum Running: Melting Pots, Mixing Pans—Spirit Varnish Manufacture: Cold Solution Plant, Mechanical Agitators, Storage Plant—Manufacture, Characteristics and Uses of the Spirit Varnishes—Manufacture of Varnish Stains—Manufacture of Lacquers—Manufacture of Spirit Enamels—Analysis of Spirit Varnishes—Physical and Chemical Constants of Resins—Table of Solubility of Resins in different Menstrua—Systematic qualitative Analysis of Resins, Hirschop's tables—Drying Oils—Oil Refining: Processes—Oil Boiling—Driers—Liquid Driers — Solidified Boiled Oil — Manufacture of Linoleum — Manufacture of India Rubber Substitutes—Printing Ink Manufacture—Lithographic Ink Manufacture—Manufacture of Oil Varnishes—Running and Special Treatment of Amber, Copal, Kauri, Manilla—Addition of Oil to Resin—Addition of Resin to Oil—Mixed Processes—Solution in Cold of previously Fused Resin—Dissolving Resins in Oil, etc., under pressure—Filtration—Clarification—Storage—Ageing—Coachmakers' Varnishes and Japans—Oak Varnishes—Japanners' Stoving Varnishes—Japanners' Gold Size—Brunswick Black—Various Oil Varnishes—Oil-Varnish Stains—Varnishes for "Enamels"—India Rubber Varnishes—Varnishes Analysis: Processes, Matching—Faults in Varnishes: Cause, Prevention—Experiments and Exercises.

DRYING OILS, BOILED OIL AND SOLID AND LIQUID DRIERS. By L. E. ANDÉS. Expressly Written for this Series of Special Technical Books, and the Publishers hold the Copyright for English and Foreign Editions. Forty-two Illustrations. 342 pp. 1901. Demy 8vo. Price 12s. 6d.; India and Colonies, 13s. 6d.; Other Countries, 15s.; strictly net.

Contents.

Properties of the Drying Oils; Cause of the Drying Property; Absorption of Oxygen; Behaviour towards Metallic Oxides, etc.—The Properties of and Methods for obtaining the Drying Oils—Production of the Drying Oils by Expression and Extraction; Refining and Bleaching; Oil Cakes and Meal; The Refining and Bleaching of the Drying Oils; The Bleaching of Linseed Oil—The Manufacture of Boiled Oil; The Preparation of Drying Oils for Use in the Grinding of Paints and Artists' Colours and in the Manufacture of Varnishes by Heating over a Fire or by Steam, by the Cold Process, by the Action of Air, and by Means of the Electric Current; The Driers used in Boiling Linseed Oil; The Manufacture of Boiled Oil and the Apparatus therefor; Livache's Process for Preparing a Good Drying Oil and its Practical Application—The Preparation of Varnishes for Letterpress, Lithographic and Copperplate Printing, for Oilcloth and Waterproof Fabrics; The Manufacture of Thickened Linseed Oil, Burnt Oil, Stand Oil by Fire Heat, Superheated Steam, and by a Current of Air—Behaviour of the Drying Oils and Boiled Oils towards Atmospheric Influences, Water, Acids and Alkalies—Boiled Oil Substitutes—The Manufacture of Solid and Liquid Driers from Linseed Oil and Rosin; Linolic Acid Compounds of the Driers—The Adulteration and Examination of the Drying Oils and Boiled Oil.

Oils, Fats, Soaps and Perfumes.

LUBRICATING OILS, FATS AND GREASES: Their Origin, Preparation, Properties, Uses and Analyses. A Handbook for Oil Manufacturers, Refiners and Merchants, and the Oil and Fat Industry in General. By GEORGE H. HURST, F.C.S. Second Revised and Enlarged Edition. Sixty-five Illustrations. 317 pp. Demy 8vo. 1902. Price 10s. 6d.; India and Colonies, 11s.; Other Countries, 12s.; strictly net.

Contents.

Introductory—Hydrocarbon Oils—Scotch Shale Oils—Petroleum—Vegetable and Animal Oils—Testing and Adulteration of Oils—Lubricating Greases—Lubrication—Appendices—Index.

TECHNOLOGY OF PETROLEUM: Oil Fields of the World—Their History, Geography and Geology—Annual Production and Development—Oil-well Drilling—Transport. By HENRY NEUBERGER and HENRY NOALHAT. Translated from the French by J. G. McINTOSH. 550 pp. 153 Illustrations. 26 Plates. Super Royal 8vo. 1901. Price 21s.; India and Colonies, 22s.; Other Countries, 23s. 6d.; strictly net.

Contents.

Study of the Petroliferous Strata—Petroleum—Definition—The Genesis or Origin of Petroleum—The Oil Fields of Galicia, their History—Physical Geography and Geology of the Galician Oil Fields—Practical Notes on Galician Land Law—Economic Hints on Working, etc.—Roumania—History, Geography, Geology—Petroleum in Russia—History—Russian Petroleum (*continued*)—Geography and Geology of the Caucasian Oil Fields—Russian Petroleum (*continued*)—The Secondary Oil Fields of Europe, Northern Germany, Alsace, Italy, etc.—Petroleum in France—Petroleum in Asia—Transcaspian and Turkestan Territory—Turkestan—Persia—British India and Burmah—British Burmah or Lower Burmah—China—Chinese Thibet—Japan, Formosa and Saghalien—Petroleum in Oceania—Sumatra, Java, Borneo—Isle of Timor—Philippine Isles—New Zealand—The United States of America—History—Physical Geology and Geography of the United States Oil Fields—Canadian and other North American Oil Fields—Economic Data of Work in North America—Petroleum in the West Indies and South America—Petroleum in the French Colonies.

Excavations—Hand Excavation or Hand Digging of Oil Wells.

Methods of Boring.

Accidents—Boring Accidents—Methods of preventing them—Methods of remedying them—Explosives and the use of the "Torpedo" Levigation—Storing and Transport of Petroleum—General Advice—Prospecting, Management and carrying on of Petroleum Boring Operations.

General Data—Customary Formulæ—Memento. Practical Part. General Data bearing on Petroleum—Glossary of Technical Terms used in the Petroleum Industry—Copious Index.

THE PRACTICAL COMPOUNDING OF OILS, TALLOW AND GREASE FOR LUBRICATION, ETC. By AN EXPERT OIL REFINER. 100 pp. 1898. Demy 8vo. Price 7s. 6d.; India and Colonies, 8s.; Other Countries, 8s. 6d.; strictly net.

Contents.

Introductory Remarks on the General Nomenclature of Oils, Tallow and Greases suitable for Lubrication—**Hydrocarbon Oils—Animal and Fish Oils—Compound Oils—Vegetable Oils—Lamp Oils—Engine Tallow, Solidified Oils and Petroleum Jelly—Machinery Greases: Loco and Anti-friction—Clarifying and Utilisation of Waste Fats, Oils, Tank Bottoms, Drainings of Barrels and Drums, Pickings Up, Dregs, etc.—The Fixing and Cleaning of Oil Tanks, etc.—Appendix and General Information.**

ANIMAL FATS AND OILS: Their Practical Production, Purification and Uses for a great Variety of Purposes. Their Properties, Falsification and Examination. Translated from the German of LOUIS EDGAR ANDÉS. Sixty-two Illustrations. 240 pp. 1898. Demy 8vo. Price 10s. 6d.; India and Colonies, 11s.; Other Countries, 12s.; strictly net.

Contents.

Introduction—Occurrence, Origin, Properties and Chemical Constitution of Animal Fats—Preparation of Animal Fats and Oils—Machinery—Tallow-melting Plant—Extraction Plant—Presses—Filtering Apparatus—Butter: Raw Material and Preparation, Properties, Adulterations, Beef Lard or Remelted Butter, Testing—Candle-fish Oil—Mutton-Tallow—Hare Fat—Goose Fat—Neatsfoot Oil—Bone Fat: Bone Boiling, Steaming Bones, Extraction, *Refining*—Bone Oil—Artificial Butter: Oleomargarine, Margarine Manufacture in France, *Grasso's Process*, "Kaiser's Butter," Jahr & Münzberg's Method, Filbert's Process, Winter's *Method*—*Human Fat*—Horse Fat—Beef Marrow—Turtle Oil—Hog's Lard: Raw Material—*Preparation, Properties*, Adulterations, Examination—Lard Oil—Fish Oils—Liver Oils—*Artificial Train Oil*—Wool Fat: Properties, Purified Wool Fat—Spermaceti: Examination of Fats and Oils in General.

THE OIL MERCHANTS' MANUAL AND OIL TRADE READY RECKONER. Compiled by FRANK F. SHERIFF. Second Edition Revised and Enlarged. Demy 8vo. 214 pp. 1904. [*In the press.*

Contents.

Trade Terms and Customs—Tables to Ascertain Value of Oil sold per cwt. or ton—Specific Gravity Tables—Percentage Tare Tables—Petroleum Tables—Paraffine and Benzoline Calculations—Customary Drafts—Tables for Calculating Allowance for Dirt, Water, etc.—Capacity of Circular Tanks Tables, etc., etc.

VEGETABLE FATS AND OILS: Their Practical Preparation, Purification and Employment for Various Purposes, their Properties, Adulteration and Examination. Translated from the German of LOUIS EDGAR ANDÉS. Ninety-four Illustrations. 340 pp. Second Edition. 1902. Demy 8vo. Price 10s. 6d.; India and Colonies, 11s.; Other Countries, 12s.; strictly net.

Contents.

General Properties—Estimation of the Amount of Oil in Seeds—The Preparation of Vegetable Fats and Oils—Apparatus for Grinding Oil Seeds and Fruits—**Installation of Oil and Fat Works**—Extraction Method of Obtaining Oils and Fats—Oil Extraction Installations—Press Moulds—**Non-drying Vegetable Oils—Vegetable drying Oils—Solid Vegetable Fats**—Fruits Yielding Oils and Fats—Wool-softening Oils—Soluble Oils—Treatment of the Oil after Leaving the Press—Improved Methods of Refining—**Bleaching Fats and Oils**—Practical Experiments on the Treatment of Oils with regard to Refining and Bleaching—Testing Oils and Fats.

SOAPS. A Practical Manual of the Manufacture of Domestic, Toilet and other Soaps. By GEORGE H. HURST, F.C.S. 390 pp. 66 Illustrations. 1898. Price 12s. 6d.; India and Colonies, 13s. 6d.; Other Countries, 15s.; strictly net.

Contents.

Introductory—Soap-maker's Alkalies—Soap Fats and Oils—Perfumes—Water as a Soap Material—Soap Machinery—Technology of Soap-making—Glycerine in Soap Lyes—Laying out a Soap Factory—Soap Analysis—Appendices.

THE CHEMISTRY OF ESSENTIAL OILS AND ARTIFICIAL PERFUMES. By ERNEST J. PARRY, B.Sc. (Lond.), F.I.C., F.C.S. 411 pp. 20 Illustrations. 1899. Demy 8vo. Price 12s. 6d.; India and Colonies, 13s. 6d.; Other Countries, 15s.; strictly net.

Contents.

The General Properties of Essential Oils—Compounds occurring in Essential Oils—The Preparation of Essential Oils—The Analysis of Essential Oils—Systematic Study of the Essential Oils—Terpeneless Oils—The Chemistry of Artificial Perfumes—Appendix: Table of Constants—**Index.**

(*For "Textile Soaps" see p.* 32.)

Cosmetical Preparations.

COSMETICS: MANUFACTURE, EMPLOYMENT AND TESTING OF ALL COSMETIC MATERIALS AND COSMETIC SPECIALITIES. Translated from the German of Dr. THEODOR KOLLER. Crown 8vo. 262 pp. 1902. Price 5s.; India and Colonies, 5s. 6d.; Other Countries, 6s. net.

Contents.

Purposes and Uses of, and Ingredients used in the Preparation of Cosmetics—Preparation of Perfumes by Pressure, Distillation, Maceration, Absorption or Enfleurage, and Extraction Methods—Chemical and Animal Products used in the Preparation of Cosmetics—Oils and Fats used in the Preparation of Cosmetics—General Cosmetic Preparations—Mouth Washes and Tooth Pastes—Hair Dyes, Hair Restorers and Depilatories—Cosmetic Adjuncts and Specialities—*Colouring* Cosmetic Preparations—Antiseptic Washes and Soaps—Toilet and *Hygienic Soaps—Secret* Preparations for Skin, Complexion, Teeth, Mouth, etc.—Testing and *Examining the Materials* Employed in the Manufacture of Cosmetics—Index.

Glue, Bone Products and Manures.

GLUE AND GLUE TESTING. By SAMUEL RIDEAL, D.Sc. (Lond.), F.I.C. Fourteen Engravings. 144 pp. Demy 8vo. 1900. Price 10s. 6d.; India and Colonies, 11s.; Other Countries, 12s.; strictly net.

Contents.

Constitution and Properties: Definitions and Sources, Gelatine, Chondrin and Allied Bodies, Physical and Chemical Properties, Classification, Grades and Commercial Varieties —**Raw Materials and Manufacture:** Glue Stock, Lining, Extraction, Washing and Clarifying, Filter Presses, Water Supply, Use of Alkalies, Action of Bacteria and of Antiseptics, Various Processes, Cleansing, Forming, Drying, Crushing, etc., Secondary Products—**Uses of Glue:** Selection and Preparation for Use, Carpentry, Veneering, Paper-Making, Bookbinding, Printing Rollers, Hectographs, Match Manufacture, Sandpaper, etc., Substitutes for other Materials, Artificial Leather and Caoutchouc—**Gelatine:** General Characters, Liquid Gelatine, Photographic Uses, Size, Tanno-, Chrome and Formo-Gelatine, Artificial Silk, Cements, Pneumatic Tyres, Culinary, Meat Extracts, Isinglass, Medicinal and other Uses, Bacteriology—**Glue Testing:** Review of Processes, Chemical Examination, Adulteration, Physical Tests, Valuation of Raw Materials—**Commercial Aspects.**

BONE PRODUCTS AND MANURES: An Account of the most recent Improvements in the Manufacture of Fat, Glue, Animal Charcoal, Size, Gelatine and Manures. By THOMAS LAMBERT, Technical and Consulting Chemist. Illustrated by Twenty-one Plans and Diagrams. 162 pp. Demy 8vo. 1901. Price 7s. 6d.; India and Colonies, 8s.; Other Countries, 8s. 6d.; strictly net.

Contents.

Chemical Composition of Bones—Arrangement of Factory—Crushing of Bones—Treatment with Benzene—Benzene in Crude Fat—Analyses of Clarified Fats—Mechanical Cleansing of Bones—Animal Charcoal—Tar and Ammoniacal Liquor, Char and Gases, from good quality Bones—Method of Retorting the Bones—Analyses of Chars—"Spent" Chars—Cooling of Tar and Ammoniacal Vapours—Value of Nitrogen for Cyanide of Potash—Bone Oil—Marrow Bones—Composition of Marrow Fat—Premier Juice—Buttons—Properties of Glue—Glutin and Chondrin—Skin Glue—Liming of Skins—Washing—Boiling of Skins—Clarification of Glue Liquors—Acid Steeping of Bones—Water System of Boiling Bones—Steam Method of Treating Bones—Nitrogen in the Treated Bones—Glue-Boiling and Clarifying-House—Plan showing Arrangement of Clarifying Vats—Plan showing Position of Evaporators—Description of Evaporators—Sulphurous Acid Generator—Clarification of Liquors—Section of Drying-House—Specification of a Glue—Size—Uses and Preparation and Composition of Size—Concentrated Size—Properties of Gelatine—Preparation of Skin Gelatine —Washing—Bleaching—Boiling—Clarification—Evaporation—Drying—Bone Gelatine—Selecting Bones—Crushing—Dissolving—Bleaching—Boiling—Properties of Glutin and Chondrin —Testing of Glues and Gelatines—The Uses of Glue, Gelatine and Size in Various Trades —Soluble and Liquid Glues—Steam and Waterproof Glues—**Manures**—Importation of Food Stuffs—Soils—Germination—Plant Life—**Natural Manures**—Water and Nitrogen in Farmyard Manure—Full Analysis of Farmyard Manure—Action on Crops—Water-Closet System —Sewage Manure—Green Manures—**Artificial Manures**—**Mineral Manures**—Nitrogenous Matters—Shoddy—Hoofs and Horns—Leather Waste—Dried Meat—Dried Blood—Superphosphates—Composition—Manufacture—Section of Manure-Shed—First and Ground Floor Plans of Manure-Shed—Quality of Acid Used—Mixings—Special Manures—Potato Manure—Dissolved Bones—Dissolved Bone Compound—Enriched Peruvian Guano—Special Manure for Garden Stuffs, etc.—Special Manures—Analyses of Raw and Finished Products—Common Raw Bones—Degreased Bones—Crude Fat—Refined Fat—Degelatinised Bones—Animal Charcoal—Bone Superphosphates—Guanos—Dried Animal Products—Potash Compounds—Sulphate of Ammonia—Extraction in Vacuo—French and British Gelatines compared —Index.

Chemicals, Waste Products and Agricultural Chemistry.

REISSUE OF **CHEMICAL ESSAYS OF C. W. SCHEELE.** First Published in English in 1786. Translated from the Academy of Sciences at Stockholm, with Additions. 300 pp. Demy 8vo. 1901. Price 5s.; India and Colonies, 5s. 6d.; Other Countries, 6s.; strictly net.

Contents.

Memoir: C. W. Scheele and his work (written for this edition by J. G. McIntosh)—On Fluor Mineral and its Acid—On Fluor Mineral—Chemical Investigation of Fluor Acid, with a View to the Earth which it Yields, by Mr. Wiegler—Additional Information Concerning Fluor Minerals—On Manganese, Magnesium, or Magnesia Vitrariorum—On Arsenic and its Acid—Remarks upon Salts of Benzoin—On Silex, Clay and Alum—Analysis of the Calculus Vesical—Method of Preparing Mercurius Dulcis Via Humida—Cheaper and more Convenient Method of Preparing Pulvis Algarothi—Experiments upon Molybdæna—Experiments on Plumbago—Method of Preparing a New Green Colour—Of the Decomposition of Neutral Salts by Unslaked Lime and Iron—On the Quantity of Pure Air which is Daily Present in our Atmosphere—On Milk and its Acid—On the Acid of Saccharum Lactis—On the Constituent Parts of Lapis Ponderosus or Tungsten—Experiments and Observations on Ether—Index.

THE MANUFACTURE OF ALUM AND THE SULPHATES AND OTHER SALTS OF ALUMINA AND IRON. Their Uses and Applications as Mordants in Dyeing and Calico Printing, and their other Applications in the Arts, Manufactures, Sanitary Engineering, Agriculture and Horticulture. Translated from the French of LUCIEN GESCHWIND. 195 Illustrations. 400 pp. Royal 8vo. 1901. Price 12s. 6d.; India and Colonies, 13s. 6d.; Other Countries, 15s.; strictly net.

Contents.

Theoretical Study of Aluminium, Iron, and Compounds of these Metals—Aluminium and its Compounds—Iron and Iron Compounds.

Manufacture of Aluminium Sulphates and Sulphates of Iron—Manufacture of Aluminium Sulphate and the Alums—Manufacture of Sulphates of Iron.

Uses of the Sulphates of Aluminium and Iron—Uses of Aluminium Sulphate and Alums—Application to Wool and Silk—Preparing and using Aluminium Acetates—Employment of Aluminium Sulphate in Carbonising Wool—The Manufacture of Lake Pigments—Manufacture of Prussian Blue—Hide and Leather Industry—Paper Making—Hardening Plaster—Lime Washes—Preparation of Non-inflammable Wood, etc.—Purification of Waste Waters—**Uses and Applications of Ferrous Sulphate and Ferric Sulphates**—Dyeing—Manufacture of Pigments—Writing Inks—Purification of Lighting Gas—Agriculture—Cotton Dyeing—Disinfectant—Purifying Waste Liquors—Manufacture of Nordhausen Sulphuric Acid—Fertilising.

Chemical Characteristics of Iron and Aluminium—Analysis of Various Aluminous or Ferruginous Products—Aluminium—**Analysing Aluminium Products**—Alunite Alumina—Sodium Aluminate—Aluminium Sulphate—**Iron**—Analytical Characteristics of Iron Salts—Analysis of Pyritic Lignite—Ferrous and Ferric Sulphates—Rouil Mordant—Index.

AMMONIA AND ITS COMPOUNDS: Their Manufacture and Uses. By CAMILLE VINCENT, Professor at the Central School of Arts and Manufactures, Paris. Translated from the French by M. J. SALTER. Royal 8vo. 114 pp. 1901. Thirty-two Illustrations. Price 5s.; India and Colonies, 5s. 6d.; Other Countries, 6s.; strictly net.

Contents.

General Considerations: Various Sources of Ammoniacal Products; Human Urine *as a Source of Ammonia*—**Extraction of Ammoniacal Products from Sewage**—*Extraction of Ammonia* **from Gas Liquor—Manufacture of Ammoniacal Compounds from Bones, Nitrogenous Waste, Beetroot Wash and Peat—Manufacture of** *Caustic Ammonia*, **and Ammonium Chloride, Phosphate and Carbonate—Recovery of Ammonia from the Ammonia-Soda Mother Liquors—Index.**

ANALYSIS OF RESINS AND BALSAMS.

Translated from the German of Dr. KARL DIETERICH. Demy 8vo. 340 pp. 1901. Price 7s. 6d.; India and Colonies, 8s.; Other Countries, 8s. 6d.; strictly net.

Contents.

Definition of Resins in General—Definition of Balsams, and especially the Gum Resins—External and Superficial Characteristics of Resinous Bodies—Distinction between Resinous Bodies and Fats and Oils—Origin, Occurrence and Collection of Resinous Substances—Classification—Chemical Constituents of Resinous Substances—Resinols—Resinot Annols—Behaviour of Resin Constituents towards the Cholesterine Reactions—Uses and Identification of Resins—Melting-point—Solvents—Acid Value—Saponification Value—Resin Value—Ester and Ether Values—Acetyl and Corbonyl Value—Methyl Value—Resin Acid—Systematic Résumé of the Performance of the Acid and Saponification Value Tests.

Balsams—Introduction—Definitions—Canada Balsam—Copaiba Balsam—Angostura Copaiba Balsam—Babia Copaiba Balsam—Carthagena Copaiba Balsam—Maracaibo Copaiba Balsam—Maturin Copaiba Balsam—Gurjum Copaiba Balsam—Para Copaiba Balsam—Surinam Copaiba Balsam—West African Copaiba Balsam—Mecca Balsam—Peruvian Balsam—Tolu Balsam—Acaroid Resin—Amine—Amber—African and West Indian Kino—Bengal Kino—Labdanum—Mastic—Pine Resin—Sandarach—Scammonium—Shellac—Storax—Adulteration of Styrax Liquidus Crudus—Purified Storax—Styrax Crudus Colatus—Tacamahac—Thapsia Resin—Turpentine—Chios Turpentine—Strassburg Turpentine—Turpeth Turpentine. **Gum Resins**—Ammoniacum—Bdellium—Euphorbium—Galbanum—Gamboge—Lactucarium—Myrrh—Opopanax—Sagapenum—Olibanum or Incense—Acaroid Rezin—Amber—Thapsia Resin—Index.

MANUAL OF AGRICULTURAL CHEMISTRY.

By HERBERT INGLE, F.I.C., Lecturer on Agricultural Chemistry, the Yorkshire College; Lecturer in the Victoria University. 388 pp. 11 Illustrations. 1902. Demy 8vo. Price 7s. 6d.; India and Colonies, 8s.; Other Countries, 8s. 6d. net.

Contents.

Introduction—The Atmosphere—The Soil—The Reactions occurring in Soils—The Analysis of Soils—Manures, Natural—Manures (continued)—The Analysis of Manures—The Constituents of Plants—The Plant—Crops—The Animal—Foods and Feeding—Milk and Milk Products—The Analysis of Milk and Milk Products—Miscellaneous Products used in Agriculture—Appendix—Index.

THE UTILISATION OF WASTE PRODUCTS.

A Treatise on the Rational Utilisation, Recovery and Treatment of Waste Products of all kinds. By Dr. THEODOR KOLLER. Translated from the Second Revised German Edition. Twenty-two Illustrations. Demy 8vo. 280 pp. 1902. Price 7s. 6d.; India and Colonies, 8s.; Other Countries, 8s. 6d.; strictly net.

Contents.

The Waste of Towns—**Ammonia and Sal-Ammoniac**—Rational Processes for Obtaining these Substances by Treating Residues and Waste—Residues in the Manufacture of Aniline Dyes—Amber Waste—Brewers' Waste—Blood and Slaughter-House Refuse—Manufactured Fuels—Waste Paper and Bookbinders' Waste—Iron Slags—Excrement—Colouring Matters from Waste—Dyers' Waste Waters—Fat from Waste—Fish Waste—Calamine Sludge—Tannery Waste—Gold and Silver Waste—India-rubber and Caoutchouc Waste—Residues in the Manufacture of Rosin Oil—Wood Waste—Horn Waste—Infusorial Earth—Iridium from Goldsmiths' Sweepings—Jute Waste—Cork Waste—Leather Waste—Glue Makers' Waste—Illuminating Gas from Waste and the By-Products of the Manufacture of Coal Gas—Meerschum—Molasses—Metal Waste—By-Products in the Manufacture of Mineral Waters—Fruit—The By-Products of Paper and Paper Pulp Works—By-Products in the Treatment of Coal Tar Oils—Fur Waste—The Waste Matter in the Manufacture of Parchment Paper—*Mother of Pearl Waste*—Petroleum Residues—Platinum Residues—Broken Porcelain. *Earthenware and Glass*—Salt Waste—Slate Waste—Sulphur—Burnt Pyrites—Silk Waste—*Soap Makers' Waste*—*Alkali* Waste and the Recovery of Soda—Waste Produced in Grinding. *Mirrors*—*Waste Products* in the Manufacture of Starch—Stearic Acid—Vegetable Ivory *Waste*—*Turf*—*Waste* Waters of Cloth Factories—Wine Residues—Tinplate Waste—Wool *Waste*—*Wool Sweat*—The Waste Liquids from Sugar Works—Index.

Writing Inks and Sealing Waxes.

INK MANUFACTURE: Including Writing, Copying, Lithographic, Marking, Stamping, and Laundry Inks. By SIGMUND LEHNER. Three Illustrations. Crown 8vo. 162 pp. 1902. Translated from the German of the Fifth Edition. Price 5s.; India and Colonies, 5s. 6d.; Other Countries, 6s.; net.

Contents.

Varieties of Ink—Writing Inks—Raw Materials of Tannin Inks—The Chemical Constitution of the Tannin Inks—Recipes for Tannin Inks—Logwood Tannin Inks—Ferric Inks—Alizarine Inks—Extract Inks—Logwood Inks—Copying Inks—Hektographs—Hektograph Inks—Safety Inks—Ink Extracts and Powders—Preserving Inks—Changes in Ink and the Restoration of Faded Writing—Coloured Inks—Red Inks—Blue Inks—Violet Inks—Yellow Inks—Green Inks—Metallic Inks—Indian Ink—Lithographic Inks and Pencils—Ink Pencils—Marking Inks—Ink Specialities—Sympathetic Inks—Stamping Inks—Laundry or Washing Blue—Index.

SEALING-WAXES, WAFERS AND OTHER ADHESIVES FOR THE HOUSEHOLD, OFFICE, WORKSHOP AND FACTORY. By H. C. STANDAGE. Crown 8vo. 96 pp. 1902. Price 5s.; India and Colonies, 5s. 6d.; Other Countries, 6s.; strictly net.

Contents.

Materials Used for Making Sealing-Waxes—The Manufacture of Sealing-Waxes—Wafers—Notes on the Nature of the Materials Used in Making Adhesive Compounds—Cements for Use in the Household—Office Gums, Pastes and Mucilages—Adhesive Compounds for Factory and Workshop Use.

Lead Ores and Compounds.

LEAD AND ITS COMPOUNDS. By THOS. LAMBERT, Technical and Consulting Chemist. Demy 8vo. 226 pp. Forty Illustrations. 1902. Price 7s. 6d.; India and Colonies, 8s.; Other Countries, 8s. 6d.; net. Plans and Diagrams.

Contents.

History—Ores of Lead—Geographical Distribution of the Lead Industry—Chemical and Physical Properties of Lead—Alloys of Lead—Compounds of Lead—Dressing of Lead Ores—Smelting of Lead Ores—Smelting in the Scotch or American Ore-hearth—Smelting in the Shaft or Blast Furnace—Condensation of Lead Fume—Desilverisation, or the Separation of Silver from Argentiferous Lead—Cupellation—The Manufacture of Lead Pipes and Sheets—Protoxide of Lead—Litharge and Massicot—Red Lead or Minium—Lead Poisoning—Lead Substitutes—Zinc and its Compounds—Pumice Stone—Drying Oils and Siccatives—Oil of Turpentine Resin—Classification of Mineral Pigments—Analysis of Raw and Finished Products—Tables—Index.

NOTES ON LEAD ORES: Their Distribution and Properties. By JAS. FAIRIE, F.G.S. Crown 8vo. 1901. 64 pages. Price 2s. 6d.; Abroad, 3s.; strictly net.

Industrial Uses of Air, Steam and Water.

DRYING BY MEANS OF AIR AND STEAM. Explanations, Formulæ, and Tables for Use in Practice. Translated from the German of E. HAUSBRAND. Two folding Diagrams and Thirteen Tables. Crown 8vo. 1901. 72 pp. Price 5s.; India and Colonies, 5s. 6d.; *Other Countries*, 6s.; strictly net.

(*For Contents see next page.*)

Contents.

British and Metric Systems Compared—Centigrade and Fahr. Thermometers—Estimation of the Maximum Weight of Saturated Aqueous Vapour which can be contained in 1 kilo. of Air at Different Pressure and Temperatures—Calculation of the Necessary Weight and Volume of Air, and of the Least Expenditure of Heat, per Drying Apparatus with Heated Air, at the Atmospheric Pressure: *A*, With the Assumption that the Air is *Completely Saturated* with Vapour both before Entry and after Exit from the Apparatus—*B*, When the Atmospheric Air is Completely Saturated *before entry*, but at its *exit* is *only* $\frac{2}{3}$, $\frac{1}{2}$ or $\frac{1}{3}$ Saturated —*C*, When the Atmospheric Air is *not* Saturated with Moisture before Entering the Drying Apparatus—Drying Apparatus, in which, in the Drying Chamber, a Pressure is Artificially Created, Higher or Lower than that of the Atmosphere—Drying by Means of Superheated Steam, without Air—Heating Surface, Velocity of the Air Current, Dimensions of the Drying Room, Surface of the Drying Material, Losses of Heat—Index.

(*See also* "*Evaporating, Condensing and Cooling Apparatus*," *p.* 26.)

PURE AIR, OZONE AND WATER. A Practical Treatise of their Utilisation and Value in Oil, Grease, Soap, Paint, Glue and other Industries. By W. B. COWELL. Twelve Illustrations. Crown 8vo. 85 pp. 1900. Price 5s.; India and Colonies, 5s. 6d.; Other Countries, 6s.; strictly net.

Contents.

Atmospheric Air; Lifting of Liquids; Suction Process; Preparing Blown Oils; Preparing Siccative Drying Oils—Compressed Air; Whitewash—Liquid Air; Retrocession—Purification of Water; Water Hardness—Fleshings and Bones—Ozonised Air in the Bleaching and Deodorising of Fats, Glues, etc.; Bleaching Textile Fibres—Appendix: Air and Gases; Pressure of Air at Various Temperatures; Fuel; Table of Combustibles; Saving of Fuel by Heating Feed Water; Table of Solubilities of Scale Making Minerals; British Thermal Units Tables; Volume of the Flow of Steam into the Atmosphere; Temperature of Steam—Index.

THE INDUSTRIAL USES OF WATER. COMPOSITION — EFFECTS—TROUBLES — REMEDIES—RESIDUARY WATERS—PURIFICATION—ANALYSIS. By H. DE LA COUX. Royal 8vo. Translated from the French. 364 pp. 135 Illustrations. 1903. Price 10s. 6d.; Colonies, 11s.; Other Countries, 12s.; strictly net.

Contents.

Chemical Action of Water in Nature and in Industrial Use—Composition of Waters—Solubility of Certain Salts in Water Considered from the Industrial Point of View—Effects on the Boiling of Water—Effects of Water in the Industries—Difficulties with Water—Feed Water for Boilers—Water in Dyeworks, Print Works, and Bleach Works—Water in the Textile Industries and in Conditioning—Water in Soap Works—Water in Laundries and Washhouses—Water in Tanning—Water in Preparing Tannin and Dyewood Extracts—Water in Papermaking—Water in Photography—Water in Sugar Refining—Water in Making Ices and Beverages—Water in Cider Making—Water in Brewing—Water in Distilling—Preliminary Treatment and Apparatus—Substances Used for Preliminary Chemical Purification—Commercial Specialities and their Employment—Precipitation of Matters in Suspension in Water —Apparatus for the Preliminary Chemical Purification of Water—Industrial Filters—Industrial Sterilisation of Water—Residuary Waters and their Purification—Soil Filtration—Purification by Chemical Processes—Analyses—Index.

(*See Books on Smoke Prevention, Engineering and Metallurgy, p.* 26, *etc.*)

Industrial Hygiene.

THE RISKS AND DANGERS TO HEALTH OF VARIOUS OCCUPATIONS AND THEIR PREVENTION. By LEONARD A. PARRY, M.D., B.S. (Lond.). 196 pp. Demy 8vo. 1900. Price 7s. 6d.; India and Colonies, 8s.; Other Countries, 8s. 6d.; strictly net.

Contents.

Occupations which are Accompanied by the Generation and Scattering of Abnormal *Quantities of Dust—Trades* in which there is Danger of Metallic Poisoning—Certain Chemical *Trades—Some Miscellaneous* Occupations—Trades in which Various Poisonous Vapours *are Inhaled—General Hygienic* Considerations—Index.

X Rays.

PRACTICAL X RAY WORK. By FRANK T. ADDYMAN, B.Sc. (Lond.), F.I.C., Member of the Roentgen Society of London; Radiographer to St. George's Hospital; Demonstrator of Physics and Chemistry, and Teacher of Radiography in St. George's Hospital Medical School. Demy 8vo. Twelve Plates from Photographs of X Ray Work. Fifty-two Illustrations. 200 pp. 1901. Price 10s. 6d.; India and Colonies, 11s.; Other Countries, 12s.; strictly net.

Contents.

Historical—Work leading up to the Discovery of the X Rays—The Discovery—**Apparatus and its Management**—Electrical Terms—Sources of Electricity—Induction Coils—Electrostatic Machines—Tubes—Air Pumps—Tube Holders and Stereoscopic Apparatus—Fluorescent Screens—**Practical X Ray Work**—Installations—Radioscopy—Radiography—X Rays in Dentistry—X Rays in Chemistry—X Rays in War—Index.

List of Plates.

Frontispiece—Congenital Dislocation of Hip-Joint.—I., Needle in Finger.—II., Needle in Foot.—III., Revolver Bullet in Calf and Leg.—IV., A Method of Localisation.—V., Stellate Fracture of Patella showing shadow of "Strapping".—VI., Sarcoma.—VII., Six-weeks-old Injury to Elbow showing new Growth of Bone.—VIII., Old Fracture of Tibia and Fibula badly set.—IX., Heart Shadow.—X., Fractured Femur showing Grain of Splint.—XI., Barrell's Method of Localisation.

India-Rubber and Gutta Percha.

INDIA-RUBBER AND GUTTA PERCHA. Translated from the French of T. SEELIGMANN, G. LAMY TORVILHON and H. FALCONNET by JOHN GEDDES MCINTOSH. Royal 8vo. Eighty-six Illustrations. Three Plates. 412 pages. 1903. Price 12s. 6d.; India and Colonies, 13s. 6d.; Other Countries, 15s.; strictly net.

Contents.

India-Rubber—Botanical Origin—Climatology—Soil—Rational Culture and Acclimation of the Different Species of India-Rubber Plants—Methods of Obtaining the Latex—Methods of Preparing Raw or Crude India-Rubber—Classification of the Commercial Species of Raw Rubber—Physical and Chemical Properties of the Latex and of India-Rubber—Mechanical Transformation of Natural Caoutchouc into Washed or Normal Caoutchouc (Purification) and Normal Rubber into Masticated Rubber—Softening, Cutting, Washing, Drying—Preliminary Observations—Vulcanisation of Normal Rubber—Chemical and Physical Properties of Vulcanised Rubber—General Considerations—Hardened Rubber or Ebonite—Considerations on Mineralisation and other Mixtures—Coloration and Dyeing—Analysis of Natural or Normal Rubber and Vulcanised Rubber—Rubber Substitutes—Imitation Rubber.

Gutta Percha—Botanical Origin—Climatology—Soil—Rational Culture—Methods of Collection—Classification of the Different Species of Commercial Gutta Percha—Physical and Chemical Properties—Mechanical Transformation—Methods of Analysing—Gutta Percha Substitutes—Index.

Leather Trades.

PRACTICAL TREATISE ON THE LEATHER INDUSTRY. By A. M. VILLON. Translated by FRANK T. ADDYMAN, B.Sc. (Lond.), F.I.C., F.C.S.; and Corrected by an Eminent Member of the Trade. 500 pp., royal 8vo. 1901. 123 Illustrations. Price 21s.; India and Colonies, 22s.; Other Countries, 23s. 6d.; strictly net.

Contents.

Preface—Translator's Preface—List of Illustrations.

Part I., **Materials used in Tanning**—Skins: Skin and its Structure; Skins used in Tanning; Various Skins and their Uses—Tannin and Tanning Substances: Tannin; Barks (Oak); Barks other than Oak; Tanning Woods; Tannin-bearing Leaves; Excrescences; Tan-bearing Fruits; Tan-bearing Roots and Bulbs; Tanning Juices; Tanning Substances used in Various Countries; Tannin Extracts; Estimation of Tannin and Tannin Principles.

Part II., ***Tanning***—The Installation of a Tannery: Tan Furnaces; Chimneys, Boilers, *etc.*; *Steam Engines*—Grinding and Trituration of Tanning Substances: Cutting up Bark; *Grinding Bark*; The Grinding of Tan Woods; Powdering Fruit, Galls and Grains; Notes on

the Grinding of Bark—Manufacture of Sole Leather: Soaking; Sweating and Unhairing; Plumping and Colouring; Handling; Tanning; Tanning Elephants' Hides; Drying; Striking or Pinning—Manufacture of Dressing Leather: Soaking; Depilation; New Processes for the Depilation of Skins; Tanning; Cow Hides; Horse Hides; Goat Skins; Manufacture of Split Hides—On Various Methods of Tanning: Mechanical Methods; Physical Methods; Chemical Methods; Tanning with Extracts—Quantity and Quality; Quantity; Net Cost; Quality of Leather—Various Manipulations of Tanned Leather: Second Tanning; Grease Stains; Bleaching Leather; Waterproofing Leather; Weighting Tanned Leather; Preservation of Leather—Tanning Various Skins.

Part III., **Currying**—Waxed Calf: Preparation; Shaving; Stretching or Slicking; Oiling the Grain; Oiling the Flesh Side; Whitening and Graining; Waxing; Finishing; Dry Finishing; Finishing in Colour; Cost—White Calf: Finishing in White—Cow Hide for Upper Leathers: Black Cow Hide; White Cow Hide; Coloured Cow Hide—Smooth Cow Hide—Black Leather—Miscellaneous Hides: Horse; Goat; Waxed Goat Skin; Matt Goat Skin—Russia Leather: Russia Leather; Artificial Russia Leather.

Part IV., **Enamelled, Hungary and Chamoy Leather, Morocco, Parchment, Furs and Artificial Leather**—Enamelled Leather: Varnish Manufacture; Application of the Enamel; Enamelling in Colour—Hungary Leather: Preliminary; Wet Work or Preparation; Aluming; Dressing or Loft Work; Tallowing; Hungary Leather from Various Hides—Tawing: Preparatory Operations; Dressing; Dyeing Tawed Skins; Rugs—Chamoy Leather—Morocco: Preliminary Operations, Morocco Tanning; Mordants used in Morocco Manufacture; Natural Colours used in Morocco Dyeing; Artificial Colours; Different Methods of Dyeing; Dyeing with Natural Colours; Dyeing with Aniline Colours; Dyeing with Metallic Salts; Leather Printing; Finishing Morocco; Shagreen; Bronzed Leather—Gilding and Silvering: Gilding; Silvering; Nickel and Cobalt—Parchment—Furs and Furriery: Preliminary Remarks; Indigenous Furs; Foreign Furs from Hot Countries; Foreign Furs from Cold Countries; Furs from Birds' Skins; Preparation of Furs; Dressing; Colouring; Preparation of Birds' Skins; Preservation of Furs—Artificial Leather: Leather made from Scraps; Compressed Leather; American Cloth; Papier Mâché; Linoleum; Artificial Leather.

Part V., **Leather Testing and the Theory of Tanning**—Testing and Analysis of Leather: Physical Testing of Tanned Leather; Chemical Analysis—The Theory of Tanning and the other Operations of the Leather and Skin Industry: Theory of Soaking; Theory of Unhairing; Theory of Swelling; Theory of Handling; Theory of Tanning; Theory of the Action of Tannin on the Skin; Theory of Hungary Leather Making; Theory of Tawing; Theory of Chamoy Leather Making; Theory of Mineral Tanning.

Part VI., **Uses of Leather**—Machine Belts: Manufacture of Belting; Leather Chain Belts; Various Belts, Use of Belts—Boot and Shoe-making: Boots and Shoes; Laces—Saddlery: Composition of a Saddle; Construction of a Saddle—Harness: The Pack Saddle; Harness—Military Equipment—Glove Making—Carriage Building—Mechanical Uses.

Appendix, **The World's Commerce in Leather**—Europe; America; Asia; Africa; Australasia—Index.

THE LEATHER WORKER'S MANUAL. Being a Compendium of Practical Recipes and Working Formulæ for Curriers, Bootmakers, Leather Dressers, Blacking Manufacturers, Saddlers, Fancy Leather Workers. By H. C. STANDAGE. 165 pp. 1900. Price 7s. 6d.; India and Colonies, 8s.; Other Countries, 8s. 6d.; strictly net.

Contents.

Blackings, Polishes, Glosses, Dressings, Renovators, etc., for Boot and Shoe Leather—Harness Blackings, Dressings, Greases, Compositions, Soaps, and Boot-top Powders and Liquids, etc., etc.—Leather Grinders' Sundries—Currier's Seasonings, Blacking Compounds, Dressings, Finishes, Glosses, etc.—Dyes and Stains for Leather—Miscellaneous Information—Chrome Tannage—Index.

Books on Pottery, Bricks, Tiles, Glass, etc.

THE MANUAL OF PRACTICAL POTTING. Compiled *by Experts, and* Edited by CHAS. F. BINNS. Revised Third Edition *and Enlarged.* 200 pp. 1901. Price 17s. 6d.; India and Colonies, *18s. 6d.; Other* Countries, 20s.; strictly net.

Contents.

Introduction. The Rise and Progress of the Potter's Art—**Bodies.** China and Porcelain Bodies, Parian Bodies, Semi-porcelain and Vitreous Bodies, Mortar Bodies, Earthenwares Granite and C.C. Bodies, Miscellaneous Bodies, Sagger and Crucible Clays, Coloured Bodies, Jasper Bodies, Coloured Bodies for Mosaic Painting, Encaustic Tile Bodies, Body Stains, Coloured Dips—**Glazes.** China Glazes, Ironstone Glazes, Earthenware Glazes, Glazes without Lead, Miscellaneous Glazes, Coloured Glazes, Majolica Colours—**Gold and Gold Colours.** Gold, Purple of Cassius, Marone and Ruby, Enamel Coloured Bases, Enamel Colour Fluxes, Enamel Colours, Mixed Enamel Colours, Antique and Vellum Enamel Colours, Underglaze Colours, Underglaze Colour Fluxes, Mixed Underglaze Colours, Flow Powders, Oils and Varnishes—**Means and Methods.** Reclamation of Waste Gold, The Use of Cobalt, Notes on Enamel Colours, Liquid or Bright Gold—**Classification and Analysis.** Classification of Clay Ware, Lord Playfair's Analysis of Clays, The Markets of the World, Time and Scale of Firing, Weights of Potter's Material, Decorated Goods Count—Comparative Loss of Weight of Clays—Ground Felspar Calculations—The Conversion of Slop Body Recipes into Dry Weight—The Cost of Prepared Earthenware Clay—**Forms and Tables.** Articles of Apprenticeship, Manufacturer's Guide to Stocktaking, Table of Relative Values of Potter's Materials, Hourly Wages Table, Workman's Settling Table, Comparative Guide for Earthenware and China Manufacturers in the use of Slop Flint and Slop Stone, Foreign Terms applied to Earthenware and China Goods, Table for the Conversion of Metrical Weights and Measures on the Continent and South America—**Index.**

CERAMIC TECHNOLOGY: Being some Aspects of Technical Science as Applied to Pottery Manufacture. Edited by CHARLES F. BINNS. 100 pp. Demy 8vo. 1897. Price 12s. 6d.; India and Colonies, 13s. 6d.; Other Countries, 15s.; strictly net.

Contents.

Preface—The Chemistry of Pottery — Analysis and Synthesis — Clays and their Components — The Biscuit Oven — Pyrometry — Glazes and their Composition — Colours and Colour-making—Index.

A TREATISE ON THE CERAMIC INDUSTRIES. A Complete Manual for Pottery, Tile and Brick Works. By EMILE BOURRY. Translated from the French by WILTON P. RIX, Examiner in Pottery and Porcelain to the City and Guilds of London Technical Institute, Pottery Instructor to the Hanley School Board. Royal 8vo. 1901. 760 pp. 323 Illustrations. Price 21s.; India and Colonies, 22s.; Other Countries, 23s. 6d.; strictly net.

Contents.

Part I., **General Pottery Methods.** Definition and History. Definitions and Classification of Ceramic Products—Historic Summary of the Ceramic Art—Raw Materials of Bodies. Clays: Pure Clay and Natural Clays—Various Raw Materials: Analogous to Clay—Agglomerative and Agglutinative—Opening—Fusible—Refractory—Trials of Raw Materials—Plastic Bodies. Properties and Composition—Preparation of Raw Materials: Disaggregation—Purification—Preparation of Bodies: By Plastic Method—By Dry Method—By Liquid Method—Formation. Processes of Formation: Throwing—Expression—Moulding by Hand, on the Jolley, by Compression, by Slip Casting—Slapping—Slipping—Drying. Drying of Bodies—Processes of Drying: By Evaporation—By Aeration—By Heating—By Ventilation—By Absorption — Glazes. Composition and Properties—Raw Materials — Manufacture and Application—Firing. Properties of the Bodies and Glazes during Firing—Description of the Kilns—Working of the Kilns — Decoration. Colouring Materials — Processes of Decoration.

Part II., **Special Pottery Methods.** Terra Cottas. Classification: Plain Ordinary, Hollow, Ornamental, Vitrified, and Light Bricks—Ordinary and Black Tiles—Paving Tiles—Pipes—Architectural Terra Cottas—Vases, Statues and Decorative Objects—Common Pottery—Pottery for Water and Filters—Tobacco Pipes—Lustre Ware—Properties and Tests for Terra Cottas — Fireclay Goods. Classification: Argillaceous, Aluminous, Carboniferous, Silicious and Basic Fireclay Goods—Fireclay Mortar (Pug)—Tests for Fireclay Goods—Faiences. Varnished Faiences—Enamelled Faiences—Silicious Faiences—Pipeclay Faiences—Pebble Work—Feldspathic Faiences—Composition, Processes of Manufacture and General Arrangements of Faience Potteries—Stoneware. Stoneware Properly So-called: Paving Tiles—Pipes—Sanitary Ware—Stoneware for Food Purposes and Chemical Productions—Architectural Stoneware—Vases, Statues and other Decorative Objects—Fine Stoneware—Porcelain. Hard Porcelain for Table Ware and Decoration, for the Fire, for Electrical *Conduits, for Mechanical Purposes*; Architectural Porcelain, and Dull or Biscuit Porcelain—*Soft Phosphated or English* Porcelain—Soft Vitreous Porcelain, French and New Sèvres—*Argillaceous Soft or Seger's* Porcelain—Dull Soft or Parian Porcelain—Dull Feldspathic *Soft Porcelain*—**Index.**

ARCHITECTURAL POTTERY. Bricks, Tiles, Pipes, Enamelled Terra-cottas, Ordinary and Incrusted Quarries, Stoneware Mosaics, Faïences and Architectural Stoneware. By LEON LEFÈVRE. With Five Plates. 950 Illustrations in the Text, and numerous estimates. 500 pp., royal 8vo. 1900. Translated from the French by K. H. BIRD, M.A., and W. MOORE BINNS. Price 15s.; India and Colonies, 16s.; Other Countries, 17s. 6d.; strictly net.

Contents.

Part I. **Plain Undecorated Pottery.—Clays, Bricks, Tiles, Pipes, Chimney Flues, Terra-cotta.**
Part II. **Made-up or Decorated Pottery.**

THE ART OF RIVETING GLASS, CHINA AND EARTHENWARE. By J. HOWARTH. Second Edition. 1900. Paper Cover. Price 1s. net; by post, home or abroad, 1s. 1d.

HOW TO ANALYSE CLAY. Practical Methods for Practical Men. By HOLDEN M. ASHBY, Professor of Organic Chemistry, Harvey Medical College, U.S.A. 74 pp. Twenty Illus. 1901. Price 2s. 6d.; Abroad, 3s.; strictly net.

NOTES ON POTTERY CLAYS. Their Distribution, Properties, Uses and Analyses of Ball Clays, China Clays and China Stone. By JAS. FAIRIE, F.G.S. 1901. 132 pp. Crown 8vo. Price 3s. 6d.; India and Colonies, 4s.; Other Countries, 4s. 6d.; strictly net.

A Reissue of

THE HISTORY OF THE STAFFORDSHIRE POTTERIES; AND THE RISE AND PROGRESS OF THE MANUFACTURE OF POTTERY AND PORCELAIN. With References to Genuine Specimens, and Notices of Eminent Potters. By SIMEON SHAW. (Originally Published in 1829.) 265 pp. 1900. Demy 8vo. Price 7s. 6d.; India and Colonies, 8s.; Other Countries, 8s. 6d.; strictly net.

Contents.

Introductory Chapter showing the position of the Pottery Trade at the present time 1899)—**Preliminary Remarks—The Potteries**, comprising Tunstall, Brownhills, Greenfield and New Field, Golden Hill, Latebrook, Green Lane, Burslem, Longport and Dale Hall, Hot Lane and Cobridge, Hanley and Shelton, Etruria, Stoke, Penkhull, Fenton, Lane Delph, Foley, Lane End—**On the Origin of the Art**, and its Practice among the early Nations—**Manufacture of Pottery**, prior to 1700—**The Introduction of Red Porcelain** by Messrs Elers, of Bradwell, 1690—**Progress of the Manufacture** from 1700 to Mr. Wedgwood's commencement in 1760—**Introduction of Fluid Glaze**—Extension of the Manufacture of Cream Colour—Mr. Wedgwood's Queen's Ware—Jasper, and Appointment of Potter to Her Majesty—Black Printing—**Introduction of Porcelain.** Mr. W. Littler's Porcelain—Mr Cookworthy's Discovery of Kaolin and Petuntse, and Patent—Sold to Mr. Champion—re-sold to the New Hall Com.—Extension of Term—**Blue Printed Pottery.** Mr. Turner, Mr Spode (1), Mr. Baddeley, Mr. Spode (2), Messrs. Turner, Mr. Wood, Mr. Wilson, Mr. Minton—Great Change in Patterns of Blue Printed—**Introduction of Lustre Pottery.** Improvements in Pottery and Porcelain subsequent to 1800.

A Reissue of

THE CHEMISTRY OF THE SEVERAL NATURAL AND ARTIFICIAL HETEROGENEOUS COMPOUNDS USED IN MANUFACTURING PORCELAIN, GLASS AND POTTERY. By SIMEON SHAW. (Originally published in 1837.) 750 pp. 1900. Royal 8vo. Price 14s.; India and Colonies, 15s.; Other Countries, 16s. 6d.; strictly net.

Contents.

PART I., ANALYSIS AND MATERIALS.—**Introduction:** Laboratory and Apparatus **Elements—Temperature—Acids and Alkalies—The Earths—Metals.**
PART II., SYNTHESIS AND COMPOUNDS.—**Science of Mixing—Bodies:** Porcelain—Hard, Porcelain—Fritted Bodies, Porcelain—Raw Bodies, Porcelain—Soft, Fritted Bodies, Raw Bodies, Stone Bodies, Ironstone, Dry Bodies, Chemical Utensils, Fritted Jasper, Fritted Pearl, Fritted Drab, Raw Chemical Utensils, Raw Stone, Raw Jasper, Raw Pearl, Raw Mortar, Raw Drab, Raw Brown, Raw Fawn, Raw Cane, Raw Red Porous, Raw Egyptian, Earthenware, Queen's Ware, Cream Colour, Blue and Fancy Printed, Dipped and Mocha, Chalky, Rings, Stilts, etc.—**Glazes:** Porcelain—Hard Fritted Porcelain—Soft Fritted Porcelain—Soft Raw, Cream Colour Porcelain, Blue Printed Porcelain, Fritted Glazes, Analysis of Fritt, Analysis of Glaze, Coloured Glazes, Dips, Smears and Washes: **Glasses:** Flint Glass, Coloured Glasses, Artificial Garnet, Artificial Emerald, Artificial Amethyst, Artificial Sapphire, Artificial Opal, Plate Glass, Crown Glass, Broad Glass, Bottle Glass, Phosphoric Glass, British Steel Glass, Glass-Staining and Painting, Engraving on Glass, Dr. Faraday's Experiments—**Colours:** Colour Making, Fluxes or Solvents, Components of the Colours; **Reds, etc., from Gold,** Carmine or Rose Colour, Purple, Reds, etc., from Iron, Blues, Yellows, Greens, Blacks, White, Silver for Burnishing, Gold for Burnishing, Printer's Oil, Lustres.
TABLES OF THE CHARACTERISTICS OF CHEMICAL SUBSTANCES.

Glassware, Glass Staining and Painting.

RECIPES FOR FLINT GLASS MAKING. By a British Glass Master and Mixer. Sixty Recipes. Being Leaves from the Mixing Book of several experts in the Flint Glass Trade, containing up-to-date recipes and valuable information as to Crystal, Demi-crystal and Coloured Glass in its many varieties. It contains the recipes for cheap metal suited to pressing, blowing, etc., as well as the most costly crystal and ruby. Crown 8vo. 1900. Price for United Kingdom, 10s. 6d.; Abroad, 15s.; United States, $4; strictly net.

Contents.

Ruby—Ruby from Copper—Flint for using with the Ruby for Coating—A German Metal—Cornelian, or Alabaster—Sapphire Blue—Crysophis—Opal—Turquoise Blue—Gold Colour—Dark Green—Green (common)—Green for Malachite—Blue for Malachite—Black for Melachite—Black—Common Canary Batch—Canary—White Opaque Glass—Sealing-wax Red—Flint—Flint Glass (Crystal and Demi)—Achromatic Glass—Paste Glass—White Enamel—Firestone—Dead White (for moons)—White Agate—Canary—Canary Enamel—Index.

A TREATISE ON THE ART OF GLASS PAINTING. Prefaced with a Review of Ancient Glass. By ERNEST R. SUFFLING. With One Coloured Plate and Thirty-seven Illustrations. Demy 8vo. 140 pp. 1902. Price 7s. 6d.; India and Colonies, 8s.; Other Countries, 8s. 6d. net.

Contents.

A Short History of Stained Glass—Designing Scale Drawings—Cartoons and the Cut Line—*Various Kinds of* Glass Cutting for Windows—The Colours and Brushes used in Glass *Painting—Painting* on Glass, Dispersed Patterns—Diapered Patterns—Aciding—Firing—*Fret Lead Glazing*—Index.

PAINTING ON GLASS AND PORCELAIN AND ENAMEL PAINTING. A Complete Introduction to the Preparation of all the Colours and Fluxes used for Painting on Porcelain, Enamel, Faience and Stoneware, the Coloured Pastes and Coloured Glasses, together with a Minute Description of the Firing of Colours and Enamels. By FELIX HERMANN, Technical Chemist. With Eighteen Illustrations. 300 pp. Translated from the German second and enlarged Edition. 1897. Price 10s. 6d.; India and Colonies, 11s.; Other Countries, 12s.; strictly net.

Contents.

History of Glass Painting—The Articles to be Painted: Glass, Porcelain, Enamel, Stoneware, Faience—Pigments: Metallic Pigments: Antimony Oxide, Naples Yellow, Barium Chromate, Lead Chromate, Silver Chloride, Chromic Oxide—Fluxes: Fluxes, Felspar, Quartz, Purifying Quartz, Sedimentation, Quenching, Borax, Boracic Acid, Potassium and Sodium Carbonates, Rocaille Flux—Preparation of the Colours for Glass Painting—The Colour Pastes—The Coloured Glasses—Composition of the Porcelain Colours—The Enamel Colours: Enamels for Artistic Work—Metallic Ornamentation: Porcelain Gilding, Glass Gilding—Firing the Colours: Remarks on Firing: Firing Colours on Glass, Firing Colours on Porcelain: The Muffle—Accidents occasionally Supervening during the Process of Firing—Remarks on the Different Methods of Painting on Glass, Porcelain, etc.—Appendix: Cleaning Old Glass Paintings.

Paper Staining.

THE DYEING OF PAPER PULP. A Practical Treatise for the use of Papermakers, Paperstainers, Students and others. By JULIUS ERFURT, Manager of a Paper Mill. Translated into English and Edited with Additions by JULIUS HÜBNER, F.C.S., Lecturer on Papermaking at the Manchester Municipal Technical School. With Illustrations and **157 patterns of paper dyed in the pulp.** Royal 8vo, 180 pp. 1901. Price 15s.; India and Colonies, 16s.; Other Countries, 20s.; strictly net. Limited edition.

Contents.

Behaviour of the Paper Fibres during the Process of Dyeing, Theory of the Mordant—Colour Fixing Mediums (Mordants)—Influence of the Quality of the Water Used—Inorganic Colours—Organic Colours—Practical Application of the Coal Tar Colours according to their Properties and their Behaviour towards the Different Paper Fibres—Dyed Patterns on Various Pulp Mixtures—Dyeing to Shade—Index.

Enamelling on Metal.

ENAMELS AND ENAMELLING. For Enamel Makers, Workers in Gold and Silver, and Manufacturers of Objects of Art. By PAUL RANDAU. Translated from the German. With Sixteen Illustrations. Demy 8vo. 180 pp. 1900. Price 10s. 6d.; India and Colonies, 11s.; Other Countries, 12s.; strictly net.

Contents.

Composition and Properties of Glass—Raw Materials for the Manufacture of Enamels—Substances Added to Produce Opacity—Fluxes—Pigments—Decolorising Agents—Testing the Raw Materials with the Blow-pipe Flame—Subsidiary Materials—Preparing the Materials for Enamel Making—Mixing the Materials—The Preparation of Technical Enamels, The Enamel Mass—Appliances for Smelting the Enamel Mass—Smelting the Charge—Composition of Enamel Masses—Composition of Masses for Ground Enamels—Composition of Cover Enamels—Preparing the Articles for Enamelling—Applying the Enamel—Firing the Ground Enamel—Applying and Firing the Cover Enamel or Glaze—Repairing Defects in Enamelled Ware—Enamelling Articles of Sheet Metal—Decorating Enamelled Ware—Specialities in Enamelling—Dial-plate Enamelling—Enamels for Artistic Purposes, Recipes for Enamels of Various Colours—Index.

***THE ART OF* ENAMELLING ON METAL.** By W. NORMAN BROWN. Twenty-eight Illustrations. Crown 8vo. 80 pp. *1900. Price* 2s. 6d.; Abroad, 3s.; strictly net.

Silk Manufacture.

SILK THROWING AND WASTE SILK SPINNING.

By HOLLINS RAYNER. Demy 8vo. 170 pp. 117 Illus. 1903. Price 5s.; Colonies, 5s. 6d.; Other Countries, 6s.; strictly net.

Contents.

The Silkworm—Cocoon Reeling and Qualities of Silk—Silk Throwing—Silk Wastes—The Preparation of Silk Waste for Degumming—Silk Waste Degumming, Schapping and Discharging—The Opening and Dressing of Wastes—Silk Waste "Drawing" or "Preparing" Machinery—Long Spinning—Short Spinning—Spinning and Finishing Processes—Utilisation of Waste Products—Noil Spinning—Exhaust Noil Spinning.

Books on Textile and Dyeing Subjects.

THE CHEMICAL TECHNOLOGY OF TEXTILE FIBRES: Their Origin, Structure, Preparation, Washing, Bleaching, Dyeing, Printing and Dressing.

By Dr. GEORG VON GEORGIEVICS. Translated from the German by CHARLES SALTER. 320 pp. Forty-seven Illustrations. Royal 8vo. 1902. Price 10s. 6d.; India and Colonies, 11s.; Other Countries, 12s. net.

Contents.

The Textile Fibres—Washing, Bleaching, Carbonising—Mordants and Mordanting—Dyeing—Printing—Dressing and Finishing.

POWER-LOOM WEAVING AND YARN NUMBERING,

According to Various Systems, with Conversion Tables. Translated from the German of ANTHON GRUNER. **With Twenty-six Diagrams in Colours.** 150 pp. 1900. Crown 8vo. Price 7s. 6d.; India and Colonies, 8s.; Other Countries, 8s. 6d.; strictly net.

Contents.

Power-Loom Weaving in General. Various Systems of Looms—**Mounting and Starting the Power-Loom.** English Looms—Tappet or Treadle Looms—Dobbies—**General Remarks on the Numbering, Reeling and Packing of Yarn—Appendix—Useful Hints.** Calculating Warps—Weft Calculations—Calculations of Cost Price in Hanks.

TEXTILE RAW MATERIALS AND THEIR CONVERSION INTO YARNS.

(The Study of the Raw Materials and the Technology of the Spinning Process.) By JULIUS ZIPSER. Translated from German by CHARLES SALTER. 302 Illustrations. 500 pp. Demy 8vo. 1901. Price 10s. 6d.; India and Colonies, 11s.; Other Countries, 12s.; strictly net.

Contents.

PART I.—The Raw Materials Used in the Textile Industry.

MINERAL RAW MATERIALS. VEGETABLE RAW MATERIALS. ANIMAL RAW MATERIALS.

PART II.—The Technology of Spinning or the Conversion of Textile Raw Materials into Yarn.

SPINNING VEGETABLE RAW MATERIALS. Cotton Spinning—Installation of a Cotton Mill—Spinning Waste Cotton and Waste Cotton Yarns—Flax Spinning—Fine Spinning—Tow Spinning—Hemp Spinning—Spinning Hemp Tow String—Jute Spinning—Spinning Jute Line Yarn—Utilising Jute Waste.

PART III.—Spinning Animal Raw Materials.

Spinning Carded Woollen Yarn—Finishing Yarn—Worsted Spinning—Finishing Worsted Yarn—*Artificial Wool or* Shoddy Spinning—Shoddy and Mungo Manufacture—Spinning *Shoddy and other Wool* Substitutes—Spinning Waste Silk—Chappe Silk—Fine Spinning—*Index.*

THE TECHNICAL TESTING OF YARNS AND TEXTILE FABRICS.

With Reference to Official Specifications. Translated from the German of Dr. J. HERZFELD. Second Edition. Sixty-nine Illustrations. 200 pp. Demy 8vo. 1902. Price 10s. 6d.; India and Colonies, 11s.; Other Countries, 12s.; strictly net.

Contents.

Yarn Testing. Determining the Yarn Number—Testing the Length of Yarns—Examination of the External Appearance of Yarn—Determining the Twist of Yarn and Twist—Determination of Tensile Strength and Elasticity—Estimating the Percentage of Fat in Yarn—Determination of Moisture (Conditioning)**—Appendix.**

DECORATIVE AND FANCY TEXTILE FABRICS.

By R. T. LORD. Manufacturers and Designers of Carpets, Damask, Dress and all Textile Fabrics. 200 pp. 1898. Demy 8vo. 132 Designs and Illustrations. Price 7s. 6d.; India and Colonies, 8s.; Other Countries, 8s. 6d.; strictly net.

Contents.

A Few Hints on Designing Ornamental Textile Fabrics—A Few Hints on Designing Ornamental Textile Fabrics (continued)—A Few Hints on Designing Ornamental Textile Fabrics (continued)—A Few Hints on Designing Ornamental Textile Fabrics (continued)—Hints for Ruled-paper Draughtsmen—The Jacquard Machine—Brussels and Wilton Carpets—Tapestry Carpets—Ingrain Carpets—Axminster Carpets—Damask and Tapestry Fabrics—Scarf Silks and Ribbons—Silk Handkerchiefs—Dress Fabrics—Mantle Cloths—Figured Plush—Bed Quilts—Calico Printing.

THEORY AND PRACTICE OF DAMASK WEAVING.

By H. KINZER and K. WALTER. Royal 8vo. Eighteen Folding Plates. Six Illustrations. Translated from the German. 110 pp. 1903. Price 8s. 6d.; Colonies, 9s.; Other Countries, 9s. 6d.; strictly net.

Contents.

The Various Sorts of Damask Fabrics—Drill (Ticking, Handloom-made)—Whole Damask for Tablecloths—Damask with Ground- and Connecting-warp Threads—Furniture Damask—Lampas or Hangings—Church Damasks—**The Manufacture of Whole Damask**—Damask Arrangement with and without Cross-Shedding—The Altered Cone-arrangement—The Principle of the Corner Lifting Cord—The Roller Principle—The Combination of the Jacquard with the so-called Damask Machine—The Special Damask Machine—The Combination of Two Tyings.

FAULTS IN THE MANUFACTURE OF WOOLLEN GOODS AND THEIR PREVENTION.

By NICOLAS REISER. Translated from the Second German Edition. Crown 8vo. Sixty-three Illustrations. 170 pp. 1903. Price 5s.; Colonies, 5s. 6d.; Other Countries, 6s.; strictly net.

Contents.

Improperly Chosen Raw Material or Improper Mixtures—Wrong Treatment of the Material in Washing, Carbonisation, Drying, Dyeing and Spinning—Improper Spacing of the Goods in the Loom—Wrong Placing of Colours—Wrong Weight or Width of the Goods—Breaking of Warp and Weft Threads—Presence of Doubles, Singles, Thick, Loose, and too Hard Twisted Threads as well as Tangles, Thick Knots and the Like—Errors in Cross-weaving—Inequalities, *i.e.*, Bands and Stripes—Dirty Borders—Defective Selvedges—Holes and Buttons—Rubbed Places—Creases—Spots—Loose and Bad Colours—Badly Dyed Selvedges—Hard Goods—Brittle Goods—Uneven Goods—Removal of Bands, Stripes, Creases and Spots.

SPINNING AND WEAVING CALCULATIONS,

especially relating to Woollens. From the German of N. REISER. Thirty-four Illustrations. Tables. Demy 8vo. 170 pp. Price 10s. 6d.; India and Colonies, 11s.; Other Countries, 12s.; strictly net.

Contents.

Calculating the Raw Material—Proportion of Different Grades of Wool to Furnish a *Mixture at a Given Price*—Quantity to Produce a Given Length—Yarn Calculations—Yarn *Number*—*Working Calculations*—Calculating the Reed Count—Cost of Weaving, etc.

WATERPROOFING OF FABRICS. By Dr. S. MIERZINSKI. Crown 8vo. 104 pp. 29 Illus. 1903. Price 5s.; Colonies, 5s. 6d.; Other Countries, 6s.; strictly net.

Contents.

Introduction—Preliminary Treatment of the Fabric—Waterproofing with Acetate of Alumina—Impregnation of the Fabric—Drying—Waterproofing with Paraffin—Waterproofing with Ammonium Cuprate—Waterproofing with Metallic Oxides—Coloured Waterproof Fabrics—Waterproofing with Gelatine, Tannin, Caseinate of Lime and other Bodies—Manufacture of Tarpaulin—British Waterproofing Patents—Index.

HOW TO MAKE A WOOLLEN MILL PAY. By JOHN MACKIE. Crown 8vo. 76 pp. 1904. Price 3s. 6d.; Colonies, 4s.; Other Countries, 4s. 6d.; net.

Contents.

Blends, Piles, or Mixtures of Clean Scoured Wools—Dyed Wool Book—The Order Book—Pattern Duplicate Books—Management and Oversight—Constant Inspection of Mill Departments—Importance of Delivering Goods to Time, Shade, Strength, etc.—Plums.

(*For "Textile Soaps" see p.* 32.)

Dyeing, Colour Printing, Matching and Dye-stuffs.

THE COLOUR PRINTING OF CARPET YARNS. Manual for Colour Chemists and Textile Printers. By DAVID PATERSON, F.C.S. Seventeen Illustrations. 136 pp. Demy 8vo. 1900. Price 7s. 6d.; India and Colonies, 8s.; Other Countries, 8s. 6d.; strictly net.

Contents.

Structure and Constitution of Wool Fibre—Yarn Scouring—Scouring Materials—Water for Scouring—Bleaching Carpet Yarns—Colour Making for Yarn Printing—Colour Printing Pastes—Colour Recipes for Yarn Printing—Science of Colour Mixing—Matching of Colours—"Hank" Printing—Printing Tapestry Carpet Yarns—Yarn Printing—Steaming Printed Yarns—Washing of Steamed Yarns—Aniline Colours Suitable for Yarn Printing—Glossary of Dyes and Dye-wares used in Wood Yarn Printing—Appendix.

THE SCIENCE OF COLOUR MIXING. A Manual intended for the use of Dyers, Calico Printers and Colour Chemists. By DAVID PATERSON, F.C.S. Forty-one Illustrations, **Five Coloured Plates, and Four Plates showing Eleven Dyed Specimens of Fabrics.** 132 pp. Demy 8vo. 1900. Price 7s. 6d.; India and Colonies, 8s.; Other Countries, 8s. 6d.; strictly net.

Contents.

Colour a Sensation; Colours of Illuminated Bodies; Colours of Opaque and Transparent Bodies; Surface Colour—Analysis of Light; Spectrum; Homogeneous Colours; Ready Method of Obtaining a Spectrum—Examination of Solar Spectrum; The Spectroscope and Its Construction; Colourists' Use of the Spectroscope—Colour by Absorption; Solutions and Dyed Fabrics; Dichroic Coloured Fabrics in Gaslight—Colour Primaries of the Scientist *versus* the Dyer and Artist; Colour Mixing by Rotation and Lye Dyeing; Hue, Purity, Brightness; Tints; Shades, Scales, Tones, Sad and Sombre Colours—Colour Mixing; Pure and Impure Greens, Orange and Violets; Large Variety of Shades from few Colours; Consideration of the Practical Primaries: Red, Yellow and Blue—Secondary Colours; Nomenclature of Violet and Purple Group; Tints and Shades of Violet; Changes in Artificial Light—Tertiary Shades; Broken Hues; Absorption Spectra of Tertiary Shades—Appendix: Four Plates with Dyed Specimens Illustrating Text—Index.

DYERS' MATERIALS: An Introduction to the Examination, Evaluation and Application of the most important Substances used in Dyeing, Printing, Bleaching and Finishing. By PAUL HEERMAN, Ph.D. Translated from the German by A. C. WRIGHT, M.A. (Oxon.), B.Sc. (*Lond.*). Twenty-four Illustrations. Crown 8vo. 150 pp. 1901. Price 5s.; India and Colonies, 5s. 6d.; Other Countries, 6s.; strictly net.

COLOUR MATCHING ON TEXTILES. A Manual intended for the use of Students of Colour Chemistry, Dyeing and Textile Printing. By DAVID PATERSON, F.C.S. Coloured Frontispiece. Twenty-nine Illustrations and **Fourteen Specimens of Dyed Fabrics.** Demy 8vo. 132 pp. 1901. Price 7s. 6d.; India and Colonies, 8s.; Other Countries, 8s. 6d.; strictly net.

Contents.

Colour Vision and Structure of the Eye—Perception of Colour—Primary and Complementary Colour Sensations—Daylight for Colour Matching—Selection of a Good Pure Light—Diffused Daylight, Direct Sunlight, Blue Skylight, Variability of Daylight, etc., etc.—Matching of Hues—Purity and Luminosity of Colours—Matching Bright Hues—Aid of Tinted Films—Matching Difficulties Arising from Contrast—Examination of Colours by Reflected and Transmitted Lights—Effect of Lustre and Transparency of Fibres in Colour Matching—Matching of Colours on Velvet Pile—Optical Properties of Dye-stuffs. Dichroism. Fluorescence—Use of Tinted Mediums—Orange Film—Defects of the Eye—Yellowing of the Lens—Colour Blindness, etc.—Matching of Dyed Silk Trimmings and Linings and Bindings—Its Difficulties—Behaviour of Shades in Artificial Light—Colour Matching of Old Fabrics, etc.—Examination of Dyed Colours under the Artificial Lights—Electric Arc, Magnesium and Dufton, Gardner Lights, Welsbach, Acetylene, etc.—Testing Qualities of an Illuminant—Influence of the Absorption Spectrum in Changes of Hue under the Artificial Lights—Study of the Causes of Abnormal Modifications of Hue, etc.

COLOUR: A HANDBOOK OF THE THEORY OF COLOUR. By GEORGE H. HURST, F.C.S. **With Ten Coloured Plates** and Seventy-two Illustrations. 160 pp. Demy 8vo. 1900. Price 7s. 6d.; India and Colonies, 8s.; Other Countries, 8s. 6d.; strictly net.

Contents.

Colour and Its Production—Cause of Colour in Coloured Bodies—Colour Phenomena and Theories—The Physiology of Light—Contrast—Colour in Decoration and Design—Measurement of Colour.

THE DYEING OF COTTON FABRICS: A Practical Handbook for the Dyer and Student. By FRANKLIN BEECH, Practical Colourist and Chemist. 272 pp. Forty-four Illustrations of Bleaching and Dyeing Machinery. Demy 8vo. 1901. Price 7s. 6d.; India and Colonies, 8s.; Other Countries, 8s. 6d.; strictly net.

Contents.

Structure and Chemistry of the Cotton Fibre—Scouring and Bleaching of Cotton—Dyeing Machinery and Dyeing Manipulations—Principles and Practice of Cotton Dyeing—Direct Dyeing; Direct Dyeing followed by Fixation with Metallic Salts; Direct Dyeing followed by Fixation with Developers; Direct Dyeing followed by Fixation with Couplers; Dyeing on Tannic Mordant; Dyeing on Metallic Mordant; Production of Colour Direct upon Cotton Fibres; Dyeing Cotton by Impregnation with Dye-stuff Solution—Dyeing Union (Mixed Cotton and Wool) Fabrics—Dyeing Half Silk (Cotton-Silk, Satin) Fabrics—Operations following Dyeing—Washing, Soaping, Drying—Testing of the Colour of Dyed Fabrics—Experimental Dyeing and Comparative Dye Testing—Index.

The book contains numerous recipes for the production on Cotton Fabrics of all kinds of a great range of colours.

THE DYEING OF WOOLLEN FABRICS. By FRANKLIN BEECH, Practical Colourist and Chemist. Thirty-three Illustrations. Demy 8vo. 228 pp. 1902. Price 7s. 6d.; India and Colonies, 8s.; Other Countries, 8s. 6d. net.

Contents.

The Wool Fibre—Structure, Composition and Properties—Processes Preparatory to Dyeing—Scouring and Bleaching of Wool—Dyeing Machinery and Dyeing Manipulations—Loose Wool Dyeing, Yarn Dyeing and Piece Dyeing Machinery—The Principles and Practice of Wool Dyeing—Properties of Wool Dyeing—Methods of Wool Dyeing—Groups of Dyes—Dyeing with the Direct Dyes—Dyeing with Basic Dyes—Dyeing with Acid Dyes—Dyeing with Mordant Dyes—Level Dyeing—Blacks on Wool—Reds on Wool—Mordanting of Wool—Orange Shades on Wool—Yellow Shades on Wool—Green Shades on Wool—Blue Shades on Wool—Violet Shades on Wool—Brown Shades on Wool—Mode Colours on Wool—Dyeing Union (Mixed Cotton Wool) Fabrics—Dyeing of Gloria—Operations following Dyeing—Washing, Soaping, Drying—Experimental Dyeing and Comparative Dye Testing—Testing of the Colour of Dyed Fabrics—Index.

Reissue of

THE ART OF DYEING WOOL, SILK AND COTTON.

Translated from the French of M. HELLOT, M. MACQUER and M. LE PILEUR D'APLIGNY. First Published in English in 1789. Six Plates. Demy 8vo. 446 pp. 1901. Price 5s.; India and Colonies, 5s. 6d.; Other Countries, 6s.; strictly net.

Contents.

Part I., **The Art of Dyeing Wool and Woollen Cloth, Stuffs, Yarn, Worsted, etc.** Part II., **The Art of Dyeing Silk.** Part III., **The Art of Dyeing Cotton and Linen Thread, together with the Method of Stamping Silks, Cottons, etc.**

THE CHEMISTRY OF DYE-STUFFS. By Dr. GEORG VON GEORGIEVICS.

Translated from the Second German Edition. 412 pp. Demy 8vo. 1903. Price 10s. 6d.; India and Colonies, 11s.; Other Countries, 12s.; strictly net.

Contents.

Introduction—Coal Tar—Intermediate Products in the Manufacture of Dye-stuffs—The Artificial Dye-stuffs (Coal-tar Dyes)—Nitroso Dye-stuffs—Nitro Dye-stuffs—Azo Dye-stuffs—Substantive Cotton Dye-stuffs—Azoxystilbene Dye-stuffs—Hydrazones—Ketoneimides—Triphenylmethane Dye-stuffs—Rosolic Acid Dye-stuffs—Xanthene Dye-stuffs—Xanthone Dye-stuffs—Flavones—Oxyketone Dye-stuffs—Quinoline and Acridine Dye-stuffs—Quinonimide or Diphenylamine Dye-stuffs—The Azine Group: Eurhodines, Safranines and Indulines—Eurhodines—Safranines—Quinoxalines—Indigo—Dye-stuffs of Unknown Constitution—Sulphur or Sulphine Dye stuffs—Development of the Artificial Dye-stuff Industry—The Natural Dye-stuffs—Mineral Colours—Index.

Bleaching and Washing.

A PRACTICAL TREATISE ON THE BLEACHING OF LINEN AND COTTON YARN AND FABRICS. By L. TAILFER, Chemical and Mechanical Engineer.

Translated from the French by JOHN GEDDES MCINTOSH. Demy 8vo. 303 pp. Twenty Illusts. 1901. Price 12s. 6d.; India and Colonies, 13s. 6d.; Other Countries, 15s.; strictly net.

Contents.

General Considerations on Bleaching—Steeping—Washing: Its End and Importance—Roller Washing Machines—Wash Wheel (Dash Wheel)—Stocks or Wash Mill—Squeezing—Lye Boiling—Lye Boiling with Milk of Lime—Lye Boiling with Soda Lyes—Description of Lye Boiling Keirs—Operations of Lye Boiling—Concentration of Lyes—Mather and Platt's Keir—Description of the Keir—Saturation of the Fabrics—Alkali used in Lye Boiling—Examples of Processes—Soap—Action of Soap in Bleaching—Quality and Quantity of Soaps to use in the Lye—Soap Lyes or Scalds—Soap Scouring Stocks—Bleaching on Grass or on the Bleaching Green or Lawn—Chemicking—Remarks on Chlorides and their Decolourising Action—Chemicking Cisterns—Chemicking—Strengths, etc.—Sours—Properties of the Acids—Effects Produced by Acids—Souring Cisterns—Drying—Drying by Steam—Drying by Hot Air—Drying by Air—Damages to Fabrics in Bleaching—Yarn Mildew—Fermentation—Iron Rust Spots—Spots from Contact with Wood—Spots incurred on the Bleaching Green—Damages arising from the Machines—Examples of Methods used in Bleaching—Linen—Cotton—The Valuation of Caustic and Carbonated Alkali (Soda) and General Information *Regarding these Bodies*—Object of Alkalimetry—Titration of Carbonate of Soda—*Comparative Table of Different Degrees of Alkalimetrical Strength*—Five Problems relative to *Carbonate of Soda*—Caustic Soda, its Properties and Uses—Mixtures of Carbonated and *Caustic Alkali*—Note on a Process of Manufacturing Caustic Soda and Mixtures of Caustic

and Carbonated Alkali (Soda)—Chlorometry—Titration—Wagner's Chlorometric Method—Preparation of Standard Solutions—Apparatus for Chlorine Valuation—Alkali in Excess in Decolourising Chlorides—Chlorine and Decolourising Chlorides—Synopsis—Chlorine—Chloride of Lime—Hypochlorite of Soda—Brochoki's Chlorozone—Various Decolourising Hypochlorites—Comparison of Chloride of Lime and Hypochlorite of Soda—Water—Qualities of Water—Hardness—Dervaux's Purifier—Testing the Purified Water—Different Plant for Purification—Filters—Bleaching of Yarn—Weight of Yarn—Lye Boiling—Chemicking—Washing—Bleaching of Cotton Yarn—The Installation of a Bleach Works—Water Supply—Steam Boilers—Steam Distribution Pipes—Engines—Keirs—Washing-Machines—Stocks—Wash Wheels—Chemicking and Souring Cisterns—Various—Buildings—Addenda—Energy of Decolourising Chlorides and Bleaching by Electricity and Ozone—Energy of Decolourising Chlorides—Chlorides—Production of Chlorine and Hypochlorites by Electrolysis—Lunge's Process for increasing the intensity of the Bleaching Power of Chloride of Lime—Trilfer's Process for Removing the Excess of Lime or Soda from Decolourising Chlorides—Bleaching by Ozone.

Cotton Spinning and Combing.

COTTON SPINNING (First Year). By THOMAS THORNLEY, Spinning Master, Bolton Technical School. 160 pp. Eighty-four Illustrations. Crown 8vo. 1901. Price 3s.; Abroad, 3s. 6d.; strictly net.

Contents.

Syllabus and Examination Papers of the City and Guilds of London Institute—Cultivation, Classification, Ginning, Baling and Mixing of the Raw Cotton—Bale-Breakers, Mixing Lattices and Hopper Feeders—Opening and Scutching—Carding—Indexes.

COTTON SPINNING (Intermediate, or Second Year). By THOMAS THORNLEY. 180 pp. Seventy Illustrations. Crown 8vo. 1901. Price 5s.; India and British Colonies, 5s. 6d.; Other Countries, 6s.; strictly net.

Contents.

Syllabuses and Examination Papers of the City and Guilds of London Institute—The Combing Process—The Drawing Frame—Bobbin and Fly Frames—Mule Spinning—Ring Spinning—General Indexes.

COTTON SPINNING (Honours, or Third Year). By THOMAS THORNLEY. 216 pp. Seventy-four Illustrations. Crown 8vo. 1901. Price 5s.; India and British Colonies, 5s. 6d.; Other Countries, 6s.; strictly net.

Contents.

Syllabuses and Examination Papers of the City and Guilds of London Institute—Cotton—The Practical Manipulation of Cotton Spinning Machinery—Doubling and Winding—Reeling—Warping—Production and Costs—Main Driving—Arrangement of Machinery and Mill Planning—Waste and Waste Spinning—Indexes.

COTTON COMBING MACHINES. By THOS. THORNLEY, Spinning Master, Technical School, Bolton. Demy 8vo. 117 Illustrations. 300 pp. 1902. Price 7s. 6d.; India and Colonies, 8s.; Other Countries, 8s. 6d. net.

Contents.

The Sliver Lap Machine and the Ribbon Cap Machine—General Description of the Heilmann *Comber—The Cam Shaft*—On the Detaching and Attaching Mechanism of the Comber—*Resetting of Combers*—The Erection of a Heilmann Comber—Stop Motions: Various Calcu—*Various Notes* and Discussions—Cotton Combing Machines of Continental Make

Collieries and Mines.

RECOVERY WORK AFTER PIT FIRES. A Description of the Principal Methods Pursued, especially in Fiery Mines, and of the Various Appliances Employed, such as Respiratory and Rescue Apparatus, Dams, etc. By ROBERT LAMPRECHT, Mining Engineer and Manager. Translated from the German. Illustrated by Six large Plates, containing Seventy-six Illustrations. 175 pp., demy 8vo. 1901. Price 10s. 6d.; India and Colonies, 11s.; Other Countries, 12s.; strictly net.

Contents.

Causes of Pit Fires—Preventive Regulations: (1) The Outbreak and Rapid Extension of a Shaft Fire can be most reliably prevented by Employing little or no Combustible Material in the Construction of the Shaft; (2) Precautions for Rapidly Localising an Outbreak of Fire in the Shaft; (3) Precautions to be Adopted in case those under 1 and 2 Fail or Prove Inefficient. Precautions against Spontaneous Ignition of Coal. Precautions for Preventing Explosions of Fire-damp and Coal Dust. Employment of Electricity in Mining, particularly in Fiery Pits. Experiments on the Ignition of Fire-damp Mixtures and Clouds of Coal Dust by Electricity—**Indications of an Existing or Incipient Fire—Appliances for Working in Irrespirable Gases:** Respiratory Apparatus; Apparatus with Air Supply Pipes; Reservoir Apparatus; Oxygen Apparatus—**Extinguishing Pit Fires:** (*a*) Chemical Means; (*b*) Extinction with Water. Dragging down the Burning Masses and Packing with Clay; (*c*) Insulating the Seat of the Fire by Dams. Dam Building. Analyses of Fire Gases. Isolating the Seat of a Fire with Dams: Working in Irrespirable Gases ("Gas-diving"): Air-Lock Work. Complete Isolation of the Pit. Flooding a Burning Section isolated by means of Dams. Wooden Dams: Masonry Dams. Examples of Cylindrical and Dome-shaped Dams. Dam Doors: Flooding the Whole Pit—**Rescue Stations:** (*a*) Stations above Ground; (*b*) Underground Rescue Stations—**Spontaneous Ignition of Coal in Bulk**—Index.

VENTILATION IN MINES. By ROBERT WABNER, Mining Engineer. Translated from the German. Royal 8vo. Thirty Plates and Twenty-two Illustrations. 240 pp. 1903. Price 10s. 6d.; India and Colonies, 11s.; Other Countries, 12s.; strictly net.

Contents.

The Causes of the Contamination of Pit Air—The Means of Preventing the Dangers resulting from the Contamination of Pit Air—Calculating the Volume of Ventilating Current necessary to free Pit Air from Contamination—Determination of the Resistance Opposed to the Passage of Air through the Pit—Laws of Resistance and Formulæ therefor—Fluctuations in the Temperament or Specific Resistance of a Pit—Means for Providing a Ventilating Current in the Pit—Mechanical Ventilation—Ventilators and Fans—Determining the Theoretical, Initial, and True (Effective) Depression of the Centrifugal Fan—New Types of Centrifugal Fan of Small Diameter and High Working Speed—Utilising the Ventilating Current to the utmost Advantage and distributing the same through the Workings—Artificially retarding the Ventilating Current—Ventilating Preliminary Workings—Blind Headings—Separate Ventilation—Supervision of Ventilation—INDEX.

HAULAGE AND WINDING APPLIANCES USED IN MINES. By CARL VOLK. Translated from the German. Royal 8vo. With Six Plates and 148 Illustrations. 150 pp. 1903. Price 8s. 6d.; Colonies, 9s.; Other Countries, 9s. 6d.; strictly net.

Contents.

Haulage Appliances—Ropes—Haulage Tubs and Tracks—Cages and Winding Appliances—Winding Engines for Vertical Shafts—Winding without Ropes—Haulage in Levels and Inclines—The Working of Underground Engines—Machinery for Downhill Haulage.

Engineering, Smoke Prevention and Metallurgy.

THE PREVENTION OF SMOKE, Combined with the Economical Combustion of Fuel. By W. C. POPPLEWELL, M.Sc., A.M.Inst., C.E., Consulting Engineer. Forty-six Illustrations. 190 pp. 1901. Demy 8vo. Price 7s. 6d.; India and Colonies, 8s.; Other *Countries, 8s. 6d.*; strictly net.

(*For Contents see next page.*)

Contents.

Fuel and Combustion—Hand Firing in Boiler Furnaces—Stoking by Mechanical Means—Powdered Fuel—Gaseous Fuel—Efficiency and Smoke Tests of Boilers—Some Standard Smoke Trials—The Legal Aspect of the Smoke Question—The Best Means to be adopted for the Prevention of Smoke—Index.

GAS AND COAL DUST FIRING. A Critical Review of the Various Appliances Patented in Germany for this purpose since 1885. By ALBERT PÜTSCH. 130 pp. Demy 8vo. 1901. Translated from the German. With 103 Illustrations. Price 7s. 6d.; India and Colonies, 8s.; Other Countries, 8s. 6d.; strictly net.

Contents.

Generators—Generators Employing Steam—Stirring and Feed Regulating Appliances—Direct Generators—Burners—Regenerators and Recuperators—Glass Smelting Furnaces—Metallurgical Furnaces—Pottery Furnace—Coal Dust Firing—Index.

THE HARDENING AND TEMPERING OF STEEL IN THEORY AND PRACTICE. By FRIDOLIN REISER. Translated from the German of the Third Edition. Crown 8vo. 120 pp. 1903. Price 5s.; India and British Colonies, 5s. 6d.; Other Countries, 6s.; strictly net.

Contents.

Steel—Chemical and Physical Properties of Steel, and their Casual Connection—Classification of Steel according to Use—Testing the Quality of Steel—Steel-Hardening—Investigation of the Causes of Failure in Hardening—Regeneration of Steel Spoilt in the Furnace—Welding Steel—Index.

SIDEROLOGY: THE SCIENCE OF IRON (The Constitution of Iron Alloys and Slags). Translated from German of HANNS FREIHERR V. JÜPTNER. 350 pp. Demy 8vo. Eleven Plates and Ten Illustrations. 1902. Price 10s. 6d.; India and Colonies, 11s.; Other Countries, 12s.; net.

Contents.

The Theory of Solution.—Solutions—Molten Alloys—Varieties of Solutions—Osmotic Pressure—Relation between Osmotic Pressure and other Properties of Solutions—Osmotic Pressure and Molecular Weight of the Dissolved Substance—Solutions of Gases—Solid Solutions—Solubility—Diffusion—Electrical Conductivity—Constitution of Electrolytes and Metals—Thermal Expansion. **Micrography.**—Microstructure—The Micrographic Constituents of Iron—Relation between Micrographical Composition, Carbon-Content, and Thermal Treatment of Iron Alloys—The Microstructure of Slags. **Chemical Composition of the Alloys of Iron.**—Constituents of Iron Alloys—Carbon—Constituents of the Iron Alloys, Carbon—Opinions and Researches on Combined Carbon—Opinions and Researches on Combined Carbon—Applying the Curves of Solution deduced from the Curves of Recalescence to the Determination of the Chemical Composition of the Carbon present in Iron Alloys—The Constituents of Iron—Iron—The Constituents of Iron Alloys—Manganese—Remaining Constituents of Iron Alloys—A Silicon—Gases. **The Chemical Composition of Slag.**—Silicate Slags—Calculating the Composition of Silicate Slags—Phosphate Slags—Oxide Slags—Appendix—Index.

EVAPORATING, CONDENSING AND COOLING APPARATUS. Explanations, Formulæ and Tables for Use in Practice. By E. HAUSBRAND, Engineer. Translated by A. C. WRIGHT, M.A. (Oxon.), B.Sc. (Lond.). With Twenty-one Illustrations and Seventy-six Tables. 400 pp. Demy 8vo. 1903. Price 10s. 6d.; India and Colonies, 11s.; Other Countries, 12s.; net.

Contents.

*Re*Coefficient of Transmission of Heat, k, and the Mean Temperature Difference, θ_m—Parallel and Opposite Currents—Apparatus for Heating with Direct Fire—The Injection of Saturated Steam—Superheated Steam—Evaporation by Means of Hot Liquids—The Transference of Heat in General, and Transference by means of Saturated Steam in Particular—The Transference of Heat from Saturated Steam in Pipes (Coils) and Double Bottoms—Evaporation in a Vacuum—The Multiple-effect Evaporator—Multiple-effect Evaporators from which Extra Steam is Taken—The Weight of Water which must be Evaporated from 100 Kilos. of Liquor in order its Original Percentage of Dry Materials from 1·25 per cent. *up to 20·70 per cent.*—The Relative Proportion of the Heating Surfaces in the Elements *of the Multiple Evaporator* and their Actual Dimensions—The Pressure Exerted by Currents *of Steam and Gas upon Floating* Drops of Water—The Motion of Floating Drops of Wate

upon which Press Currents of Steam—The Splashing of Evaporating Liquids—The Diameter of Pipes for Steam, Alcohol, Vapour and Air—The Diameter of Water Pipes—The Loss of Heat from Apparatus and Pipes to the Surrounding Air, and Means for Preventing the Loss—Condensers—Heating Liquids by Means of Steam—The Cooling of Liquids—The Volumes to be Exhausted from Condensers by the Air-pumps—A Few Remarks on Air-pumps and the Vacua they Produce—The Volumetric Efficiency of Air-pumps—The Volumes of Air which must be Exhausted from a Vessel in order to Reduce its Original Pressure to a Certain Lower Pressure—Index.

Dental Metallurgy.

DENTAL METALLURGY: MANUAL FOR STUDENTS AND DENTISTS. By A. B. GRIFFITHS, Ph.D. Demy 8vo. Thirty-six Illustrations. 1902. 200 pp. Price 7s. 6d.; India and Colonies, 8s.; Other Countries, 8s. 6d.; strictly net.

Contents.

Introduction—Physical Properties of the Metals—Action of Certain Agents on Metals—Alloys—Action of Oral Bacteria on Alloys—Theory and Varieties of Blowpipes—Fluxes—Furnaces and Appliances—Heat and Temperature—Gold—Mercury—Silver—Iron—Copper—Zinc—Magnesium—Cadmium—Tin—Lead—Aluminium—Antimony—Bismuth—Palladium—Platinum—Iridium—Nickel—Practical Work—Weights and Measures.

Plumbing, Decorating, Metal Work, etc., etc.

EXTERNAL PLUMBING WORK. A Treatise on Lead Work for Roofs. By JOHN W. HART, R.P.C. 180 Illustrations. 272 pp. Demy 8vo. Second Edition Revised. 1902. Price 7s. 6d.; India and Colonies, 8s.; Other Countries, 8s. 6d.; strictly net.

Contents.

Cast Sheet Lead—Milled Sheet Lead—Roof Cesspools—Socket Pipes—Drips—Gutters—Gutters (continued)—Breaks—Circular Breaks—Flats—Flats (continued)—Rolls on Flats—Roll Ends—Roll Intersections—Seam Rolls—Seam Rolls (continued)—Tack Fixings—Step Flashings—Step Flashings (continued)—Secret Gutters—Soakers—Hip and Valley Soakers—Dormer Windows—Dormer Windows (continued)—Dormer Tops—Internal Dormers—Skylights—Hips and Ridging—Hips and Ridging (continued)—Fixings for Hips and Ridging—Ornamental Ridging—Ornamental Curb Rolls—Curb Rolls—Cornices—Towers and Finials—Towers and Finials (continued)—Towers and Finials (continued)—Domes—Domes (continued)—Ornamental Lead Work—Rain Water Heads—Rain Water Heads (continued)—Rain Water Heads (continued).

HINTS TO PLUMBERS ON JOINT WIPING, PIPE BENDING AND LEAD BURNING. Third Edition, Revised and Corrected. By JOHN W. HART, R.P.C. 184 Illustrations. 313 pp. Demy 8vo. 1901. Price 7s. 6d.; India and Colonies, 8s.; Other Countries, 8s. 6d.; strictly net.

Contents.

Pipe Bending—Pipe Bending (continued)—Pipe Bending (continued)—Square Pipe Bendings—Half-circular Elbows—Curved Bends on Square Pipe—Bossed Bends—Curved Plinth Bends—Rain-water Shoes on Square Pipe—Curved and Angle Bends—Square Pipe Fixings—Joint-wiping—Substitutes for Wiped Joints—Preparing Wiped Joints—Joint Fixings—Plumbing Irons—Joint Fixings—Use of "Touch" in Soldering—Underhand Joints—Blown and Copper Bit Joints—Branch Joints—Branch Joints (continued)—Block Joints—Block Joints (continued)—Block Fixings—Astragal Joints—Pipe Fixings—Large Branch Joints—Large Underhand Joints—Solders—Autogenous Soldering or Lead Burning—Index.

WORKSHOP WRINKLES for Decorators, Painters, Paperhangers and Others. By W. N. BROWN. Crown 8vo. 128 pp. 1901. *Price 2s. 6d.*; Abroad, 3s.; strictly net.

SANITARY PLUMBING AND DRAINAGE. By JOHN W. HART. Demy 8vo. With 208 Illustrations. 250 pp. 1904. Price 7s. 6d.; India and Colonies, 8s.; Other Countries, 8s. 6d.; strictly net.

Contents.

Sanitary Surveys—Drain Testing—Drain Testing with Smoke—Testing Drains with Water—Drain Plugs for Testing—Sanitary Defects—Closets—Baths and Lavatories—House Drains—Manholes—Iron Soil Pipes—Lead Soil Pipes—Ventilating Pipes—Water-closets—Flushing Cisterns—Baths—Bath Fittings—Lavatories—Lavatory Fittings—Sinks—Waste Pipes—Water Supply—Ball Valves—Town House Sanitary Arrangements—Drainage—Jointing Pipes—Accessible Drains—Iron Drains—Iron Junctions—Index.

THE PRINCIPLES AND PRACTICE OF DIPPING, BURNISHING, LACQUERING AND BRONZING BRASS WARE. By W. NORMAN BROWN. 35 pp. Crown 8vo. 1900. Price 2s.; Abroad, 2s. 6d.; strictly net.

HOUSE DECORATING AND PAINTING. By W. NORMAN BROWN. Eighty-eight Illustrations. 150 pp. Crown 8vo. 1900. Price 3s. 6d.; India and Colonies, 4s.; Other Countries, 4s. 6d.; strictly net.

A HISTORY OF DECORATIVE ART. By W. NORMAN BROWN. Thirty-nine Illustrations. 96 pp. Crown 8vo. 1900. Price 2s. 6d.; Abroad, 3s.; strictly net.

A HANDBOOK ON JAPANNING AND ENAMELLING FOR CYCLES, BEDSTEADS, TINWARE, ETC. By WILLIAM NORMAN BROWN. 52 pp. and Illustrations. Crown 8vo. 1901. Price 2s.; Abroad, 2s. 6d.; net.

THE PRINCIPLES OF HOT WATER SUPPLY. By JOHN W. HART, R.P.C. With 129 Illustrations. 1900. 177 pp., demy 8vo. Price 7s. 6d.; India and Colonies, 8s.; Other Countries, 8s. 6d.; strictly net.

Contents.

Water Circulation—The Tank System—Pipes and Joints—The Cylinder System—Boilers for the Cylinder System—The Cylinder System—The Combined Tank and Cylinder System—Combined Independent and Kitchen Boiler—Combined Cylinder and Tank System with Duplicate Boilers—Indirect Heating and Boiler Explosions—Pipe Boilers—Safety Valves—Safety Valves—The American System—Heating Water by Steam—Steam Kettles and Jets—Heating Power of Steam—Covering for Hot Water Pipes—Index.

Brewing and Botanical.

HOPS IN THEIR BOTANICAL, AGRICULTURAL AND TECHNICAL ASPECT, AND AS AN ARTICLE OF COMMERCE. By EMMANUEL GROSS, Professor at the Higher Agricultural College, Tetschen-Liebwerd. Translated from the German. Seventy-eight Illustrations. 1900. 340 pp. Demy 8vo. Price 12s. 6d.; India and Colonies, 13s. 6d.; Other Countries, 15s.; strictly net.

Contents.

HISTORY OF THE HOP—THE HOP PLANT—Introductory—The Roots—The Stem—and Leaves—Inflorescence and Flower: Inflorescence and Flower of the Male Hop; Inflorescence and Flower of the Female Hop—The Fruit and its Glandular Structure: The *Fruit and Seed*—*Propagation* and Selection of the Hop—Varieties of the Hop: (*a*) Red Hops; (*b*) *Green Hops*; (*c*) Pale Green Hops—Classification according to the Period of Ripening: *Early August Hops*; Medium Early Hops; Late Hops—Injuries to Growth—Leaves Turning *Yellow, Summer or* Sunbrand, Cones Dropping Off, Honey Dew, Damage from Wind, Hai

and Rain; Vegetable Enemies of the Hop: Animal Enemies of the Hop—Beneficial Insects on Hops—CULTIVATION—The Requirements of the Hop in Respect of Climate, Soil and Situation: Climate; Soil; Situation—Selection of Variety and Cuttings—Planting a Hop Garden: Drainage; Preparing the Ground; Marking-out for Planting; Planting; Cultivation and Cropping of the Hop Garden in the First Year—Work to be Performed Annually in the Hop Garden: Working the Ground; Cutting; The Non-cutting System; The Proper Performance of the Operation of Cutting: Method of Cutting: Close Cutting, Ordinary Cutting, The Long Cut, The Topping Cut; Proper Season for Cutting: Autumn Cutting, Spring Cutting: Manuring: Training the Hop Plant: Poled Gardens, Frame Training; Principal Types of Frames; Pruning, Cropping, Topping, and Leaf Stripping the Hop Plant; Picking, Drying and Bagging—Principal and Subsidiary Utilisation of Hops and Hop Gardens—Life of a Hop Garden; Subsequent Cropping—Cost of Production, Yield and Selling Prices.

Preservation and Storage—Physical and Chemical Structure of the Hop Cone—Judging the Value of Hops.

Statistics of Production—The Hop Trade—Index.

Timber and Wood Waste.

TIMBER: A Comprehensive Study of Wood in all its Aspects (Commercial and Botanical), showing the Different Applications and Uses of Timber in Various Trades, etc. Translated from the French of PAUL CHARPENTIER. Royal 8vo. 437 pp. 178 Illustrations. 1902. Price 12s. 6d.; India and Colonies, 13s. 6d.; Other Countries, 15s.; net.

Contents.

Physical and Chemical Properties of Timber—Composition of the Vegetable Bodies—Chief Elements—M. Fremy's Researches—Elementary Organs of Plants and especially of Forests—Different Parts of Wood Anatomically and Chemically Considered—General Properties of Wood—**Description of the Different Kinds of Wood**—Principal Essences with Caducous Leaves—Coniferous Resinous Trees—**Division of the Useful Varieties of Timber in the Different Countries of the Globe**—European Timber—African Timber—Asiatic Timber—American Timber—Timber of Oceania—**Forests**—General Notes as to Forests; their Influence—Opinions as to Sylviculture—Improvement of Forests—Unwooding and Rewooding—Preservation of Forests—Exploitation of Forests—Damage caused to Forests—Different Alterations—**The Preservation of Timber**—Generalities—Causes and Progress of Deterioration—History of Different Proposed Processes—Dessication—Superficial Carbonisation of Timber—Processes by Immersion—Generalities as to Antiseptics Employed—Injection Processes in Closed Vessels—The Boucherie System, Based upon the Displacement of the Sap—Processes for Making Timber Uninflammable—**Applications of Timber**—Generalities—Working Timber—Paving—Timber for Mines—Railway Traverses—Accessory Products—Gums—Works of M. Fremy—Resins—Barks—Tan—Application of Cork—The Application of Wood to Art and Dyeing—Different Applications of Wood—Hard Wood—Distillation of Wood—Pyroligneous Acid—Oil of Wood—Distillation of Resins—Index.

THE UTILISATION OF WOOD WASTE. Translated from the German of ERNST HUBBARD. Crown 8vo. 192 pp. 1902. Fifty Illustrations. Price 5s.; India and Colonies, 5s. 6d.; Other Countries, 6s.; net.

Contents.

General Remarks on the Utilisation of Sawdust—Employment of Sawdust as Fuel, with and without Simultaneous Recovery of Charcoal and the Products of Distillation—Manufacture of Oxalic Acid from Sawdust—Process with Soda Lye; Thorn's Process; Bohlig's Process—Manufacture of Spirit (Ethyl Alcohol) from Wood Waste—Patent Dyes (Organic Sulphides, Sulphur Dyes, or Mercapto Dyes)—Artificial Wood and Plastic Compositions from Sawdust—Production of Artificial Wood Compositions for Moulded Decorations—Employment of Sawdust for Blasting Powders and Gunpowders—Employment of Sawdust for Briquettes—Employment of Sawdust in the Ceramic Industry and as an Addition to Mortar—Manufacture of Paper Pulp from Wood—Casks—Various Applications of Sawdust and Wood Refuse—Calcium Carbide—Manure—Wood Mosaic Plaques—Bottle Stoppers—Parquetry—Fire-lighters—Carborundum—The Production of Wood Wool—Bark—Index.

Building and Architecture.

THE PREVENTION OF DAMPNESS IN BUILDINGS: with Remarks on the Causes, Nature and Effects of Saline, Efflorescences and Dry-rot, for Architects, Builders, Overseers, Plasterers, Painters and House Owners. By ADOLF WILHELM KEIM. Translated from the German of the second revised Edition by M. J. SALTER, F.I.C., F.C.S. Eight Coloured Plates and Thirteen Illustrations. Crown 8vo. 115 pp. 1902. Price 5s.; India and Colonies, 5s. 6d.; Other Countries, 6s.; net.

Contents.

The Various Causes of Dampness and Decay of the Masonry of Buildings, and the Structural and Hygienic Evils of the Same—Precautionary Measures during Building against Dampness and Efflorescence—Methods of Remedying Dampness and Efflorescences in the Walls of Old Buildings—The Artificial Drying of New Houses, as well as Old Damp Dwellings, and the Theory of the Hardening of Mortar—New, Certain and Permanently Efficient Methods for Drying Old Damp Walls and Dwellings—The Cause and Origin of Dry-rot: its Injurious Effect on Health, its Destructive Action on Buildings, and its Successful Repression—Methods of Preventing Dry-rot to be Adopted During Construction—Old Methods of Preventing Dry-rot—Recent and More Efficient Remedies for Dry-rot—Index.

HANDBOOK OF TECHNICAL TERMS USED IN ARCHITECTURE AND BUILDING, AND THEIR ALLIED TRADES AND SUBJECTS. By AUGUSTINE C. PASSMORE. Demy 8vo. 380 pp. 1904. Price 7s. 6d.; India and Colonies, 8s.; Other Countries, 8s. 6d.; strictly net, post free.

Foods and Sweetmeats.

THE MANUFACTURE OF PRESERVED FOODS AND SWEETMEATS. By A. HAUSNER. With Twenty-eight Illustrations. Translated from the German of the third enlarged Edition. Crown 8vo. 225 pp. 1902. Price 7s. 6d.; India and Colonies, 8s.; Other Countries, 8s. 6d.; net.

Contents.

The Manufacture of Conserves—Introduction—The Causes of the Putrefaction of Food—The Chemical Composition of Foods—The Products of Decomposition—The Causes of Fermentation and Putrefaction—Preservative Bodies—The Various Methods of Preserving Food—The Preservation of Animal Food—Preserving Meat by Means of Ice—The Preservation of Meat by Charcoal—Preservation of Meat by Drying—The Preservation of Meat by the Exclusion of Air—The Appert Method—Preserving Flesh by Smoking—Quick Smoking—Preserving Meat with Salt—Quick Salting by Air Pressure—Quick Salting by Liquid Pressure—Gamgee's Method of Preserving Meat—The Preservation of Eggs—Preservation of White and Yolk of Egg—Milk Preservation—Condensed Milk—The Preservation of Fat—Manufacture of Soup Tablets—Meat Biscuits—Extract of Beef—The Preservation of Vegetable Foods in General—Compressing Vegetables—Preservation of Vegetables by Appert's Method—The Preservation of Fruit—Preservation of Fruit by Storage—The Preservation of Fruit by Drying—Drying Fruit by Artificial Heat—Roasting Fruit—The Preservation of Fruit with Sugar—Boiled Preserved Fruit—The Preservation of Fruit in Spirit, Acetic Acid or Glycerine—Preservation of Fruit without Boiling—Jam Manufacture—The Manufacture of Fruit Jellies—The Making of Gelatine Jellies—The Manufacture of "Sulzen"—The Preservation of Fermented Beverages—**The Manufacture of Candies**—Introduction—The Manufacture of Candied Fruit—The Manufacture of Boiled Sugar and Caramel—The Candying of Fruit—Caramelised Fruit—The Manufacture of Sugar Sticks, or Barley Sugar—Bonbon Making—*Fruit Drops*—*The Manufacture of Dragées*—The Machinery and Appliances used in Candy *Manufacture*—*Dyeing* Candies and Bonbons—Essential Oils used in Candy Making—*Fruit Essences*—*The Manufacture of* Filled Bonbons, Liqueur Bonbons and Stamped Lozenges—*Recipes for Jams and Jellies*—Recipes for Bonbon Making—Dragées—Appendix—Index.

Dyeing Fancy Goods.

THE ART OF DYEING AND STAINING MARBLE, ARTIFICIAL STONE, BONE, HORN, IVORY AND WOOD, AND OF IMITATING ALL SORTS OF WOOD. A Practical Handbook for the Use of Joiners, Turners, Manufacturers of Fancy Goods, Stick and Umbrella Makers, Comb Makers, etc. Translated from the German of D. H. SOXHLET, Technical Chemist. Crown 8vo. 168 pp. 1902. Price 5s.; India and Colonies, 5s. 6d.; Other Countries, 6s.; net.

Contents.

Mordants and Stains — Natural Dyes—Artificial Pigments—Coal Tar Dyes — Staining Marble and Artificial Stone—Dyeing, Bleaching and Imitation of Bone, Horn and Ivory—Imitation of Tortoiseshell for Combs: Yellows, Dyeing Nuts—Ivory—Wood Dyeing—Imitation of Mahogany: Dark Walnut, Oak, Birch-Bark, Elder-Marquetry, Walnut, Walnut-Marquetry, Mahogany, Spanish Mahogany, Palisander and Rose Wood, Tortoiseshell, Oak, Ebony, Pear Tree—Black Dyeing Processes with Penetrating Colours—Varnishes and Polishes: English Furniture Polish, Vienna Furniture Polish, Amber Varnish, Copal Varnish, Composition for Preserving Furniture—Index.

Lithography, Printing and Engraving.

PRACTICAL LITHOGRAPHY. By ALFRED SEYMOUR. Demy 8vo. With Frontispiece and 33 Illus. 120 pp. 1903. Price 5s.; Colonies, 5s. 6d.; Other Countries, 6s.; net.

Contents.

Stones—Transfer Inks—Transfer Papers—Transfer Printing—Litho Press—Press Work—Machine Printing—Colour Printing—Substitutes for Lithographic Stones—Tin Plate Printing and Decoration—Photo-Lithography.

PRINTERS' AND STATIONERS' READY RECKONER AND COMPENDIUM. Compiled by VICTOR GRAHAM. Crown 8vo. 1904. [*In the press.*

Contents.

Price of Paper per Sheet, Quire, Ream and Lb.—Cost of 100 to 1000 Sheets at various Sizes and Prices per Ream—Cost of Cards—Quantity Table—Sizes and Weights of Paper, Cards, etc.—Notes on Account Books—Discount Tables—Sizes of spaces — Leads to a lb.—Dictionary—Measure for Bookwork—Correcting Proofs, etc.

ENGRAVING FOR ILLUSTRATION. HISTORICAL AND PRACTICAL NOTES. By J. KIRKBRIDE. 72 pp. Two Plates and 6 Illustrations. Crown 8vo. 1903. Price 2s. 6d.; Abroad, 3s.; strictly net.

Contents.

Its Inception—Wood Engraving—Metal Engraving—Engraving in England—Etching—Mezzotint — Photo-Process Engraving — The Engraver's Task—Appreciative Criticism—Index.

Bookbinding.

PRACTICAL BOOKBINDING. By PAUL ADAM. Translated from the German. Crown 8vo. 180 pp. 127 Illustrations. 1903. Price 5s.; Colonies, 5s. 6d.; Other Countries, 6s.; net.

Contents.

Materials for Sewing and Pasting—Materials for Covering the Book—Materials for Decorating and Finishing — Tools—General Preparatory Work — Sewing — Forwarding, Cutting, Rounding and Backing—Forwarding, Decoration of Edges and Headbanding—Boarding—*Preparing the Cover*—Work with the Blocking Press—Treatment of Sewn Books, *Fastening in Covers, and Finishing Off*—Handtooling and Other Decoration—Account Books—*School Books, Mounting* Maps, Dr s, etc.—Index.

Sugar Refining.

THE TECHNOLOGY OF SUGAR [illegible] on the Sugar Cane and [illegible] Sugar Refining and Sugar Boiling. [illegible]

Contents.

[illegible]

Bibliography.

[illegible] TECHNICAL AND COMMERCIAL BOOKS [illegible] GREENWOOD. [illegible] the Principal Books and [illegible] Publishers [illegible]

Contents.

[illegible]

TEXTILE SOAPS AND OILS [illegible] on the Preparation of Soaps and Oils used in Textile [illegible] By DAVIDE H. HURST, F.C.S. [illegible] Price 5s., India and [illegible]

Contents.

[illegible] Special Textile Soaps—Wool [illegible] Soap to Water for Industrial [illegible] Printers and Dyers' [illegible] Soap. [illegible] Tallow—Lard—Bone Grease—[illegible] Olive Oil—Cotton [illegible] Palm Oil—Sperm Oil [illegible] for Soft or Dyeing, Printing and [illegible] Turkey Red Oils—Soluble Oil—[illegible] Soap Softening—Testing an [illegible]

[illegible] any of the above Books, *post free* [illegible] at the published price, or they can be obtained [illegible] Booksellers.

Full Lists of Contents of any of the books will be sent on application, and [illegible] in the press will be sent when ready to persons sending name and address.

SCOTT, GREENWOOD & CO.,
Technical Book Publishers,
19 LUDGATE HILL, LONDON, E.C.